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# CONTRIBUTIONS TO EMBRYOLOGY

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# ON THE FATE OF THE HUMAN EMBRYO IN TUBAL PREGNANCY

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BY FRANKLIN P. MALL

*Director of Department of Embryology, Carnegie Institution of Washington*

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## INTRODUCTION.

The following study on tubal pregnancy is to be regarded somewhat as a by-product from our embryological collection. Originally we were of the opinion that the very earliest stages of human development would be found in a recent tubal pregnancy removed by the surgeon. Before 1897 physicians were under the impression that an embryological collection should consist only of normal specimens, and the first tubal pregnancy added to the collection (No. 109) was sent to us by Dr. Cushing because it contained a normal embryo. We soon found that we would not obtain very early specimens by this method from the fact that the diagnosis of tubal pregnancy is made much too late. The smallest normal specimen we have received (No. 808) contained an embryo 6 weeks old. The very small tubes which have been sent invariably contained pathological embryos or small ova without embryos. According to our records 59 per cent of tubal pregnancies fall in the latter class. In 46 carefully selected cases from Dr. Kelly's clinic this percentage is raised to 84.8; if we could collect all cases of tubal pregnancy, the probabilities are that it would be still higher.

The normal specimens accumulated slowly among the numbers of our collection below 500. In this group 21 out of 27 specimens, which had been examined by physicians before they were sent to the laboratory, contained normal embryos. Among the specimens that had not been previously examined, only 4 out of 19 were normal. (See table 1.)

TABLE 1.—*List of specimens reviewed in this publication (total number 117).*

Normal embryos.				Pathological embryos.				Pathological ova.		
Examined before received.		Not exam- ined before received.	Examined before received.	Not examined before received.		Examined before received.	Not examined before received.			
Nos. 109	Nos. 456	Nos. 183	Nos. 307	Nos. 196	Nos. 685	Nos. 369	Nos. 154	Nos. 540	Nos. 772	
175	458	389	314	324	697	378	298	553	773	
179	481	431		342	729	472	361	561	775	
197	487	484		396	766	495	367	575	777	
256	496	535		477	784	570	415	602	787	
294	497	576		478	804		418	659	794	
338c	503	597		479	838		430	673	809b	
350	634	612		524	846		488	686	809c	
352	640	657		554	881		507	694	815	
390	667	670		567	882		513	720	825	
422	790	706					514	726	835	
426	851	728					515	734	874	
432	867	808					517	741	889	
448	898						519	754	891	
449	899						520	762	892	
							539	765a		
30		13	2	20		5	47			

I have been able to collect three sets of statistics regarding the frequency of normal and pathological embryos and pathological ova in tubal pregnancy. The first includes specimens examined by physicians who sent them to us; to the second

belong those not previously examined, which means that in these there was no selection; the third is made up of unruptured specimens examined in the gynecological laboratory of the Johns Hopkins Hospital before 1908. These data are given in table 2.

TABLE 2.

	Normal embryos.		Pathological embryos.		Pathological ova.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Specimens sent to me after they had been examined.....	30	81	2	5.5	5	13.5
Specimens sent to me without any previous examination (mostly unruptured).....	13	16	20	25	47	59
46 unruptured specimens examined in Dr. Kelly's laboratory.....	2	4.3	5	10.9	39	84.8

Table No. 2 gives number and percentage of normal embryos, pathological embryos, and pathological ova obtained (1) from specimens that had been previously examined; (2) from those which had not been previously examined, *i. e.*, unselected; (3) from 46 unruptured specimens from Dr. Kelly's laboratory.

It is of interest to consider together the pathological ova obtained from tubal pregnancies, for it is through a study of these that light may be thrown upon the question whether their condition is inherited or is due to faulty environment. In the former case, the percentage of pathological embryos should be the same as among those obtained from the uterus; in the latter, the percentage should be increased.

Various writers have stated that in tubal pregnancies embryos are rarely found, but that remnants of the chorion are common. Nevertheless the proviso is made that when the tube has been found ruptured and much blood has escaped into the peritoneal cavity, the embryo may have been present, but may not have been found on account of the great quantity of blood. On the other hand, Professor Brödel informed me in 1907 that among 11 cases of tubal pregnancies recorded in his catalogue of human embryos 9 normal specimens were found. At that time 7 tubal pregnancies out of 19 in our collection contained normal embryos. It must be remembered that at that time the rule of surgeons was to withhold the pathological specimens and to send us only the normal embryos. Taking into consideration, then, only the tubes that were sent to us unopened, and excluding those obtained from Dr. Kelly's gynecological laboratory, I found in 7 specimens 2 ova without embryos, 4 with pathological embryos, and only 1 with a normal embryo. The other 6 normal embryos spoken of above were all recognized by the surgeons as "normal and valuable specimens" before they came into our hands.

Following the hint obtained by considering all the specimens coming to us unopened, I collected all of the histories of similar specimens from Dr. Kelly's laboratory. These covered a period of about 10 years and were taken from the laboratory records of over 10,000 miscellaneous cases. I found 128 cases of tubal pregnancy which were carefully described from numerous microscopic sections. I

have excluded the reports of 82 of these specimens in which the tubes had ruptured before the operation. Of the 46 that remain the histories state that they were unruptured and varied from 1 to 6 cm. in diameter; 2 of the 46 contained normal embryos of the second month and in 5 of them pathological embryos were present. The rest, 39 in number, contained entire ova without embryos or simply villi of the chorion in various stages of degeneration. Usually the dilated tube was found filled with blood, through which were found scattered villi, the chorion rarely being intact, that is, it was not encircling a coelom. The chorion had collapsed, leaving scattered villi, which were variously described in different cases as "degenerated," "poorly formed," or "necrotic." Usually it is stated in the records, "Scattered villi were present in the clot; no embryo was found."

The normal embryos need not be discussed more than to mention that the amnion was very small, as is usually the case in these specimens. The pathological specimens, however, show a similar nature and degree of degeneration as in specimens obtained from the uterus. A number of small specimens which were cut into serial sections contained no embryos at all; they are included among the 39 mentioned above. From my experience in searching for embryos in pathological ova I am of the opinion that a few more pathological embryos would have been found had the specimens been examined with greater care. It is unlikely, however, that more normal embryos would have been discovered, inasmuch as they always lie in a coelom or in an amnion filled with clear fluid. I have never found a normal embryo in an ovum which did not contain a cavity showing a definite sharp wall and filled with transparent fluid. Hence, I believe that those who made the sections for microscopical examination could hardly have overlooked any normal embryos.

These data, which were obtained 7 years ago, form the basis of the present study. By reference to table 2 a comparison can readily be made between the number of specimens which came to me after preliminary examination, between those which were not examined and the 46 unruptured cases from Dr. Kelly's laboratory. The difference between the first and second lines of the table is easy to explain. In the specimens represented in the first line a selection was made by the surgeon, whereas those of the second line were unselected. The difference between the second and third lines is more difficult to explain. In all probability Dr. Kelly's statistics include more small specimens than mine, for frequently the surgeon sends apologies with a small specimen containing no embryo. I am inclined to believe that many small specimens were discarded by the surgeons as worthless for our purposes. Again, the question of early diagnosis must not be overlooked. It is probable that in well-regulated clinics tubal pregnancy is recognized more readily than in outside practice. In fact, most of the very small specimens in our collection came from the Johns Hopkins Hospital. That the number of pathological embryos found in our statistics is larger than in Dr. Kelly's is easy to explain. My examinations were probably more thorough. At the preliminary examination we also found only 10 per cent of pathological embryos, whereas more careful search brought this percentage up to 25. Had serial sections been made of all of these specimens it would no doubt have been higher.

The larger percentage of normal specimens in the first line of the table is also easily explained. There was a tendency to send us "beautiful specimens," and these often contained normal embryos, for example, No. 657. We must assume that, in the routine of a laboratory, practically all normal specimens will be discovered by the pathologist, and with this assumption we may conclude that the first set of statistics (line 1, table 2) represents 455 cases, and the second set (line 2), 520 cases, provided the diagnoses were as accurate and as early as at the Johns Hopkins Hospital.

The small tubes which have been received are, in many respects, the most interesting, and I regret very much that we have been deprived of the privilege of examining more of them. In this material the very small ova were found, as well as tubes without ova, showing also most interesting pathological changes. In such specimens the younger normal embryos will ultimately be found. The question that interests us most, namely, the cause of tubal pregnancy, will be answered satisfactorily only from the study of very early specimens.

This paper is to be viewed as our fourth contribution to the pathology of the human embryo. The first was published in the Welch Festschrift in 1900, the second in the Vaughan Festschrift in 1903, and the third in the Journal of Morphology in 1908. In the third study a group of tubal pregnancies was considered, inasmuch as it gave us an opportunity of comparing pathological embryos found in the tube with those obtained from the uterus.

The first tubal specimen was obtained in 1897 from Dr. Harvey Cushing. It contained a normal embryo, 10.5 mm. long, which was studied with great care and has been found useful and referred to in some forty publications. Not long after pathological tubal specimens began to be added to the collection, and a small group of these was first considered in my paper on monsters mentioned above. Since 1908 I have made an especial effort to collect tubal pregnancies, and of late these have accumulated so rapidly that I am enabled to include 117 in this report.<sup>1</sup>

#### ACKNOWLEDGMENTS.

The 117 specimens of tubal pregnancy have been received from the following sources: From the Johns Hopkins Hospital, 26; from the Hebrew Hospital, 5; from the Church Home and Infirmary, 5; from the Franklin Square Hospital, 3; from the Union Protestant Infirmary, St. Joseph's, St. Agnes', the University and Woman's Hospitals, Baltimore, 1 each; from the Brooklyn Hospital, 2; from Bellevue Hospital, 5; from the Bender Hygiene Laboratory, 3; from St. Peter's Hospital, 1; from the Ontario County (New York) Laboratory, 1; from the Bridgeport (Conn.) General Hospital, 1; from Christ Hospital, New Jersey, 1; from the Marine Eye and Ear Hospital, Maine, 1; from Sibley Hospital, Washington, D. C., 1; from the Frederick City (Maryland) Hospital, 1; from the New England Hospital, Massachusetts, 1; from physicians and hospitals undesignated, 54.

The physicians sending me the specimens have been credited in the protocols. To them, as well as to the hospital authorities, I am deeply indebted for the opportunity which has made this study possible.

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<sup>1</sup>The "Addendum" includes 29 new specimens, making 146 in all.

I wish to express my thanks especially to Dr. Herbert M. Evans, Research Associate in the Carnegie Institution of Washington, for his successful efforts in collecting specimens and for his aid in working up embryological material.

During the past two years it has been possible to expedite the work through generous aid from the Carnegie Institution of Washington. Much better histories are now obtained than formerly, thanks to the efficiency of a private secretary; microscopic examinations have been greatly facilitated by competent technical assistants, and the illustrations have been markedly improved through the skill of a talented artist. A study of the protocols will show that those of recent date are more complete than the earlier ones.

The specimens here described, together with the rest of my human embryos, have been presented to the Carnegie Institution of Washington to form the nucleus of the collection of its newly established Department of Embryology.

### CAUSE OF TUBAL PREGNANCY.

According to Williams, it is now generally admitted that tubal pregnancy is due to a preceding salpingitis, which interferes in some way with the downward movement of the fertilized ovum. This idea had previously been put forward by Schroeder and Tait, but as it was not definitely known at that time that fertilization takes place in the tube, the theory did not seem to explain fully the occurrence of tubal pregnancy and therefore did not meet with immediate acceptance. More careful anatomical studies by Williams and other investigators demonstrated that under certain conditions and in certain cases tubal pregnancy was due to normal diverticula from the tube lumen, which caught up the fertilized ovum in its passage towards the uterus. Nevertheless, subsequent studies have demonstrated that this would account for a very small number of cases, leaving the cause in the larger number to be explained in some other way.

The view held at the present day is supported by proof that in many cases a tubal pregnancy has been preceded by pelvic inflammatory trouble. Thus Dührssen, Mandl and Schmidt, Küstner, Petersen, Runge, and others were able to elicit a history of gonorrheal salpingitis or of inflammatory lesions of the appendages in more than two-thirds of their cases. But, again, after it had been demonstrated that the arrest of the ovum was not always due to the destruction of the cilia by the inflammatory process, great difficulty was experienced in explaining the connection between the two conditions. In 1912, however, Opitz found definite histological inflammatory lesions in two-thirds of his specimens, and, even when they were absent, noted that the tips of many of the folds of the mucosa had become fused together, so that the section showed in places the cribriform appearance characteristic of the so-called follicular salpingitis, and as similar lesions were frequently present in the opposite non-pregnant tube, he held that they afforded a very satisfactory explanation for the arrest of the ovum. He assumed that some of the canals inclosed between the adherent folds communicated freely with the main lumen of the tube, but ended blindly at the other extremity, so that if a fertilized ovum were arrested in a cul-de-sac a tubal pregnancy would develop.



The same observer examined with great care 23 cases and found that in nearly all of them the folds of the tube were hypertrophied and grown together at many points, forming in transverse sections a network in the tube lumen. At other points there were outgrowths of the epithelial tube, forming glandlike structures in the muscular wall. All these changes he believed to be due to some earlier inflammatory process which had brought about the production of numerous pockets which could easily have arrested the ovum. He also found that in the majority of cases there had been sterility before tubal pregnancy had taken place. Many of the instances were in women who had borne several children, and then after a lapse of years had had a tubal pregnancy. In multiparæ tubal pregnancy seldom followed immediately after marriage. These observations, taken in connection with the clinical signs of pelvic inflammation, would indicate that a slow inflammatory process had taken place before pregnancy occurred in the tube. In general, our own specimens confirm Williams's view that the chief cause of tubal pregnancy is due to a condition improperly called "follicular salpingitis." These "follicles" are in reality partitions formed by adherent folds which with the lower power of the microscope give the appearance of follicles. This condition, however, is not always present and certain investigators even deny its occurrence, but whenever I have examined with care a portion of the tube between the pregnancy and the uterus, I have nearly always found marked changes in the form of the lumen of the tube wall, either with follicular formation or numerous outpouchings of the epithelial lining. In some instances I found multiple lumina; in one there were as many as 20.

In more recent anatomical studies by Wallgren reference is frequently made to inflammatory conditions accompanying tubal pregnancy, but it is not clearly stated whether these conditions should be viewed as the cause or the effect of the misplacement of the ovum. Wallgren gives a very detailed description of four cases which he had studied in complete serial sections, thereby enabling him to give a comprehensive view of the condition of the tube wall. It is clear that such a method is more satisfactory than when occasional sections cut from different portions of a greatly enlarged tube are examined, yet I do not believe that as much is to be gained through the very laborious work of complete sets of serial sections as Wallgren would lead us to believe. Any marked alteration in the tube wall would probably cover a large area and therefore could be found in individual sections, as I have myself found and as is indicated by the studies of Opitz.

The various earlier beliefs regarding the implantation of the ovum in the uterus—namely, that it must be clasped by a decidua—made it extremely difficult to understand how the ovum could become attached to the tube where no decidua or only a poorly developed one appears. This difficulty, however, has now been fully overcome, since it has been shown by von Spee and by Peters that the normal ovum burrows through the mucous membrane and implants itself against the muscular wall of the uterus, the decidua forming later. A similar condition could easily take place in the tube, and an abundant experience shows us that, in case the ovum is not detached, it rapidly burrows through the thin tubal wall and causes an early rupture. Such an active process must necessarily be accompanied by a

severe reaction, and this may account for the severe inflammatory process seen in the neighborhood of the implanted ovum in the tube. Wallgren recognizes all this and also admits that in the attachment of the ovum to the tube wall there must be a large number of variations. He finds himself unable to describe a single normal type of implantation, for in some instances it may be due to a kink in the tube wall, in others to a congenital diverticulum, while in still others the cause may be a constriction due to an inflammatory process. For this reason he does not exclude chronic inflammation of the tube, which in some way may cause a constriction of its lumen. In fact, he is not inclined to admit that tubal pregnancy is usually due to salpingitis. The chief reason for this statement seems to be that he could not determine whether or not the marked inflammatory process observed was primary or secondary. In a study of the normal tube beyond the region of the pregnancy he was unable to confirm the work of Opitz, for in most instances he found that there is but slight change in the tube wall between the ovum and the uterus. Furthermore, in specimens containing the older embryos he did not find that the change was more pronounced than in those containing the smaller ones. To me this does not seem to be an argument against the view of Opitz.

In the earlier part of this paper it was stated that the specimens with numbers below 500 usually came to the laboratory without the tube wall, or in the examination the tube wall was omitted; later on, in specimens somewhat above 500, the tube wall was at first occasionally examined, and finally the complete examination was added to the routine. Hence it follows that in general the condition of the tube wall can be considered systematically only in the second half of the tubal pregnancies. As far as this examination has now been carried on, we can in general confirm the work of Opitz, namely, that the folds of the tube wall are hypertrophic, inflamed, and united at their tips, giving on transverse sections a reticulated appearance; in other words, they show a "follicular salpingitis." This is frequently the condition found in the uterine end of the tube, which often appears to be abnormal. When normal it is lined with delicate folds which are in no way attached to one another, nor do they obstruct the tube lumen. However, if such specimens be examined with great care, we frequently find, at the periphery of the greatest dilatation, a mass of hypertrophic and adherent folds, forming a localized follicular salpingitis, and for our purpose this is sufficiently marked to account for the lodgment of the ovum within the tube. We can readily imagine that the protrusion formed by the enlarged folds, as well as the pockets between them and the tube wall, might arrest the ovum in its descent. It may be that on account of this enlargement the cilia could not propel the ovum, nor could this be brought about by a vermicular action of the muscular wall of the tube, provided it still acts normally. Even if we admit that the ovum does have the power to wander, it would be difficult to understand how it could escape from one of these pockets in case it got caught in it. In other words, it seems quite clear that frequently localized changes in the mucous membrane of the tube are sufficiently marked in many of the cases to account for the arrest of the ovum in the tube. On the other hand, there is another possibility, namely, that the localized follicular salpingitis is due to the presence of the ovum, which in its attachment to the tube produces a marked inflammatory

reaction and changes which are expressed by the hypertrophy and adhesion of the folds. If this objection could be removed definitely, it would be found that localized salpingitis is common in inflamed and adherent tubes without pregnancy. Proof of this can not be produced at present, but we already have other evidence which points in the same direction. When the ovum develops normally in the tube and becomes well adherent to the wall, the inflammatory reaction is usually slight and does not appear to be due to infection, whereas, in those cases in which the tubal folds are adherent, there is often a very marked inflammatory reaction, indicating that a bacterial infection exists; in fact, the accumulation of leucocytes is often so great as to form abscesses. This would seem to indicate that the inflammation, which expresses itself in the changes of the tube wall, in turn causes the arrest of the ovum.

#### TUBAL PREGNANCY WITH NORMAL EMBRYOS.

The minimal changes are found in the tube wall in cases in which the embryo is normal. They are more pronounced in the specimens containing pathological embryos and are most marked in those in which the embryo has been entirely destroyed and the ovum has undergone extensive degeneration.

In only 25 per cent of our specimens containing normal embryos have we data which bear upon their ages, and in only a few of these cases are there any observations on the condition of the tube wall. In 5 cases (Nos. 175, 179, 183, 387, 898) it is stated that tubal abortion had taken place. This would indicate that with the embryo normal, 10 per cent end in tubal abortion.

The first specimen (No. 109) contains a beautiful normal embryo and an extensive normal implantation of the chorion in the tube wall. This point is illustrated (plate 1) and will also be discussed more extensively later on in this article. The tube wall has not been examined with care, except where it is in apposition with the chorion. Here there is no indication of infection. The only point bearing upon this question is that the specimen came from an immoral woman.

A few additional data may be given of the specimens belonging to this group. In No. 183 there is a group of pockets in the tube wall to one side of the chorion. The same is true for specimen No. 503. In this the folds are very pronounced and each is filled with very large venous sinuses. In No. 790 there is a well-marked salpingitis. The tube folds are matted together. The chorionic membrane appears to be normal, but some of the villi are fibrous and degenerated. This specimen contains an embryo 20 mm. long, and is from a woman 28 years of age, who had been married 7 years, this being her first pregnancy. The history states that the year after her marriage she began to suffer with uterine trouble, and was operated upon by a surgeon who removed uterine polypi. Several years later she was operated upon twice for a similar condition. At the time of the operation it was found that the uterus was markedly enlarged. No doubt we are here dealing with an inflamed condition which may have been due to infection, the uterus being enlarged and the inflammatory condition expressing itself in the uterine end of the tube, which shows hypertrophy, the folds being matted together. In Nos. 867 and 898 the wall of the tube is markedly inflamed.

## TUBAL PREGNANCY WITH PATHOLOGICAL EMBRYOS.

One-half of the specimens containing pathological embryos were accompanied with data bearing upon their age. A few data also were given regarding the condition of the lining of the tube. Specimen No. 479 came from a woman who had been suffering from pelvic attacks for at least four years. At the time of the operation it was found that the other tube was adherent to the appendix. In No. 524 a pathological embryo, 15 mm. long, was found within a large amniotic cavity surrounded by a hemorrhagic chorion at least 15 mm. thick. The tube wall around it was markedly inflamed, numerous abscesses being present. At one point within the sections made, the folds were very hypertrophic and the tips were adherent to one another, forming numerous pockets sufficient to account for the arrest of the ovary in the tube.

No. 697, which contains a small pathological embryo and a very hemorrhagic chorion, was surrounded by a slit which separated it from the tube wall. This space contained numerous folds of the tube which were united to one another, forming a reticulated zone of mucosa between the hemorrhagic mass and the muscular wall of the tube. Outpocketings and follicular salpingitis were found in the uterine end of the tube. There was no history of venereal infection or pathological change in the uterus, although the woman had aborted four times. However this may be, there was evidently a pathological condition of the tube wall sufficient to account for the tubal pregnancy.

No. 729 is an unusually interesting specimen containing a pathological embryo. The illustrations (plate 10) show a case of ruptured tubal pregnancy with the ovum still attached to the tube walls. Sections were cut through the middle of this specimen and through the tube on both the distal and central sides of the pregnancy. From the sections it is seen that the trophoblast is extremely active, eating its way through the muscular wall and into the sides of the large blood-vessels. In one instance one-half of a thick-walled artery has been eaten away, the other side, however, appearing to be perfectly normal. We have here a case in which the implantation was certainly sound. Sections through the uterine end of the tube show that the mucosa is thrown into folds, but they are not adherent to one another. The epithelial lining, however, has formed diverticula into the muscular layer, giving a glandular appearance which will be discussed in speaking of the next group. This type of change is by no means uncommon; in one instance, instead of a single lumen, there are at least 20 lumina. Into one of these, if the main lumen should be missed, the ovum could easily implant itself. At any rate, we seem to have here a specimen of implantation in the muscular wall, because the ovum is burrowing through it so rapidly. The history of the case shows that rupture occurred at a point about 1 cm. from the uterus and that the outer end of the tube was matted together by adhesions. The woman had been married for 6 years and had been pregnant 4 times; the first two pregnancies had ended in an abortion at 6 weeks, and the third went to full term, ending in the birth of a healthy child. The patient had acquired syphilis 2 years before she was married; a gonorrheal infection was doubtful.

Nos. 567, 784, 804, 846, 881, and 882 all show pathological changes in the tube wall. In No. 804 there are outpocketings, in No. 846 the folds in the fimbriated end are adherent, in No. 881 there are outpocketings with adherent folds, and in No. 882 there are outpocketings in the uterine end of the tube and follicular salpingitis on the fimbriated end, with a history of gonorrhea.

### TUBAL PREGNANCY WITH PATHOLOGICAL OVA.

In the third group of tubal pregnancies containing pathological ova there are more specimens and also more data than in the first two groups. In this group there are 47 specimens, in 40 of which we have data. It is definitely stated that in 6 cases the tube wall was normal, while in 21 it was pathological.<sup>1</sup> In other cases the data are of a nature to indicate that some inflammatory process may have taken place. The histological studies, however, are not complete enough to bear upon this point. Table 3 gives the main facts of these cases. It is at once seen that the changes in the tubal wall are of two varieties: (1) those in which the folds grow into the lumen, and (2) those in which the ends of the epithelial lining grow away from the lumen into the muscular coat. In both cases pockets are formed. The two varieties are well illustrated in No. 418 and No. 472. In No. 418 the ovum and the

TABLE 3.—47 cases of tubal pregnancy with pathological ova (40 with data).

No.	Menstrual age, in weeks.	Remarks.	No.	Menstrual age in weeks.	Remarks.
298	3	Tubal abortion. Youngest child 11 years old.	734	2	20 lumina on uterine end. Diverticula.
361	7		741	20	Tube abnormal.
367	2		754	1	Follicular salpingitis.
369	3		762	6	Adhesion. One child, 5 years old.
415	6	Follicular salpingitis. Multiple lumina near uterus. Diverticula from lumen of tube. Infected corpus luteum. Pelvic pains for a year. Open cavity in ovary. Follicular salpingitis. Diverticula from lumen of tube wall.	765a	8	5 previous pregnancies.
418	5		772	4	Tube normal.
472	..		773	..	Tube abnormal.
488	6		775	..	Tube abnormal (?).
513	..		777	11	Follicular salpingitis.
515	..		787	6	Follicular salpingitis.
517	..		794	7	Tube wall normal.
519	..		809b	..	Outpocketings.
540	..		809c	2	Fimbriated end inflamed.
553	..		815	5	Follicular salpingitis.
561	11	Tube inflamed. One child, 11 years old. Tube wall normal (?). Follicular salpingitis.	825	4 (?)	Tube inflamed; gonorrhea.
570	6		835	..	Normal tube wall.
673	11		874	7	Follicular salpingitis.
686	..		889	6	Marked inflammation.
720	7		891	2	Marked inflammation.
726	12		892	10	Outpocketings and follicular salpingitis.

organized clot are encircled with a zone of large folds, which are matted together, expressing a very pronounced follicular salpingitis. In the free tube lumen beyond the pregnancy the hypertrophied folds anastomose freely, forming a reticulum across the lumen. In No. 472, which is from a case of hysterectomy for pelvic disease, a few fibrous villi are found in one of the tubes. These lie in a cleft within a thick tube wall. From this cleft there are a few large gland-like outgrowths into the muscular wall, forming marked pockets into which an ovum could easily implant

<sup>1</sup>The tube wall has been re-examined and found to be pathological in Nos. 507, 513, 561, 567, 602, 659, 694, and 765a.

itself. The variations of these two varieties of outgrowths are seen in succeeding specimens (Nos. 488 and 513). In Nos. 515 and 517 we have indications of infection. In the first case an infected corpus luteum was found, and in the second there had been pelvic pain for a year. In a third case belonging to this group (No. 519) a large open cavity was found within the ovary.

A very remarkable specimen is No. 734, which is from a tubal pregnancy with a menstrual history of two weeks (plate 9, fig. 2). The uterine end of the tube is markedly hypertrophied and shows large strands of muscular tissue, between which radiate numerous outgrowths of diverticula from the tube lumen; in fact, we may say that instead of one there are twenty lumina. A typical case of follicular salpingitis is shown in No. 726 (plate 8, fig. 5). The tube lumen on the uterine side of the pregnancy is very large, about 5 mm. in diameter, and completely cut up by numerous anastomosing folds of its mucous lining. At some points the outgrowths are so numerous as to remind one very much of a section through the villi of the intestine. There is also evidence of infection. In the case of No. 488, which will be taken up in greater detail subsequently and for which we have a very complete history, the trouble must have originated from induced abortions, which caused pelvic trouble ending in two tubal pregnancies. Here also there is a follicular salpingitis.

Nos. 741 and 773 are especially interesting, since they indicate that the tubal pregnancy originated from a pocket in which the ovum had lodged. The first is from a long-standing pregnancy, the operation having taken place about 20 weeks after the last menstrual period. There was a large pus tube on the opposite side, while on the pregnant side was a well-organized clot containing the form of a degenerate ovum (plate 8). On cross-sections the clot appears mottled, being cut up by numerous fibrous bands between which are fresh hemorrhages. The tube wall is also markedly inflamed. On one side the clot is penetrated by degenerated folds associated with a large mass of leucocytes. Apparently we are dealing here with secondary changes in the folds of a localized follicular salpingitis. This condition is also well represented in No. 773. Here the main part of the ovum is encircled by a crescent-shaped shell composed of degenerated folds of the tube wall. The ovum had apparently eaten through the walls of one of these pockets, thus entering the main lumen of the tube, which became filled with blood, causing its distension. Lying within the lumen of the tube is a compartment from which the ovum has escaped. There has evidently been a destruction of the mucous folds which formerly produced this compartment.

Of the 9 specimens bearing numbers between 800 and 900, 8 show pathological changes in the tube wall. There are either outpocketings or a follicular salpingitis or both, often associated with a history of severe inflammation or sometimes of gonorrhea.

From the review of this group it is evident that a sufficient number of the specimens show alterations in the tube wall marked enough to allow the generalization that tubal pregnancy is usually caused by obstructions within the tube due to an inflammatory process. These changes are of two varieties; in the first, a morphological condition produces a hypertrophy of the folds within the tube, whereas in

the second there is an outgrowth of the epithelial lining into the muscular coat. In both conditions pockets are formed in which the ovum lodges in its passage through the tube. Of course this does not exclude other mechanical factors, such as kinking, as the cause of tubal pregnancy.

In the older specimens examined, as, for instance, in No. 741, we see the later stage of this abnormal process, namely, the ovum eating its way through the walls of the pockets into the tube lumen. In practically all cases there is a very free hemorrhage in the tube lumen, and this helps to destroy the ovum. Finally, the ovum and clot may become completely separated from the tube wall, and if the mass is lodged within the fimbriated end it may be easily extruded into the abdominal cavity. On the other hand, if it has lodged in the uterine end this part of the tube does not appear to dilate so easily. The ovum eats into the muscular wall and usually produces perforation. In typical cases the ovum lies in the middle of the tube, and while it does not destroy the muscular wall, it becomes encircled with a mass of blood and ceases to grow. The clot organizes, and if it is not removed by the surgeon it gradually contracts and healing occurs. In many of these cases only a few degenerated villi are found in a highly organized clot.

### FERTILITY AND STERILITY

It has been repeatedly observed that the larger number of tubal pregnancies are found in women who are mothers, but who have not been pregnant for a number of years, or in women who have been married for a relatively long time but who have never been pregnant. It is also well known that tubal pregnancy frequently occurs in women who have been treated for salpingitis. In fact, Engström operated four times for tubal pregnancy on women who had been treated for salpingitis on the same side on which the pregnancy was found. These data point very decidedly toward a causal relation between an acquired inflammatory process and tubal pregnancy.

According to Ahlfeld (*Lehrbuch der Geburtshilfe*, Leipzig, 1903) tubal pregnancy is due to obstructions in the tube lumen which arrest the ovum in its passage to the uterus. These abnormalities in the tube frequently follow inflammation of the perimetrium, which explains the greater frequency of tubal pregnancy in women who have already borne children. The adhesions around the uterus produce a kinking of the tube and a catarrhal inflammation of its lining membrane.

Ahlfeld states further that tubal pregnancy is relatively more frequent in large cities. This may be due partly to the fact that the patients have freer access to good surgeons, but also to the higher percentage of gonorrhea in these communities. Thus, during a period of 16 years, Ahlfeld observed only two cases of tubal pregnancy in his clinics in Giessen and Marburg, and that this was not due to faulty diagnosis is proved by the fact that gynecological patients often remained in his clinics for long periods of time and he frequently opened the abdominal cavity for other reasons; furthermore, no case of tubal pregnancy came to autopsy. Most of his patients came from country districts, and Ahlfeld states that gonorrhea is of much rarer occurrence among the country people of Hesse than in large cities. Nevertheless,

during the 5 years following those 16, with an increase of gynecological patients in Marburg, there was a marked increase of cases of tubal pregnancy. To what extent venereal diseases play a causal rôle in tubal pregnancy remains an open question, but this much seems to be certain: gonorrhea is at least one of the causes of the inflammatory changes which obstruct the tube-lumen and thereby favor the arrest of the ovum in its passage through the tube.

In all his wide experience Tait states that he never saw a case of unruptured tubal pregnancy (*Lectures on Ectopic Pregnancy*, Birmingham, 1888), and in fact he doubted very much whether a diagnosis could be made before rupture, although as early as 1710 Petit had maintained to the contrary. At the time Tait wrote tubal pregnancy was believed to be a rare disease and the peasant women around Marburg may not have gone to Ahlfeld's clinic for a minor complaint. Hence the condition may not have been recognized. Now that unruptured tubes are frequently removed and found to contain only a few villi, we must conclude that without operative interference many of the patients would get well. Again, sometimes tubal abortion occurs, and the ovum may degenerate, together with its encircling clot. Even with rupture, therefore, the disease may not prove fatal. All these possibilities must be taken into account in the further discussion and investigation of the causal relation of gonorrhea and tubal pregnancy.

In discussing the frequency of diverticula in the tube a difficulty arises from the fact that we possess no suitable standard to follow. Whenever the diverticulum is very pronounced—as, for instance, when it can be found with a probe, where there is a double ostium, or when the uterine end of the tube is obliterated—we could readily account for the arrest of the ovum in its passage to the uterus. However, in most cases of tubal pregnancy anomalies of this kind are not found, but instead we have inflammatory changes which have produced adhesions between the folds in the tube. As a result, there are produced numerous small pockets, any of which might be able to catch up the ovum. Unfortunately, so far we have never examined a specimen from a very early case of tubal pregnancy, and in the somewhat advanced cases the ovum is found not in the folds of the tube, but well implanted within the muscular wall. Hence it would seem that if the ovum is caught up in the small pocket it immediately proceeds to burrow into the tube wall, and later there is a secondary rupture into the tube lumen. This is the condition seen in our youngest specimen, No. 808.

The form of the tube lumen has been carefully studied by Kroemer in a single case. He cut serial sections of a tube which appeared to be normal. The specimen came from a multipara, 48 years old. To the naked eye the tube, which was 9 cm. long, seemed perfectly normal. It was hardened immediately in formalin and cut into serial sections  $15\mu$  thick. Reconstructions were made from three portions of the tube, from the interstitial portion, from the middle of the isthmus, and from the middle of the ampulla. Kroemer found that throughout its length the tube showed definite folds, beginning within the uterus and becoming more and more pronounced as the fimbriated end was approached; he also found a number of



diverticula, some of which were quite pronounced. In fact, he is of the opinion that a third of all tubes will probably show such anomalies, and in view of their great frequency he believes that they are of little importance as the cause of tubal pregnancy. Under normal conditions the ciliated cells of the tube will carry the ovum over such a pocket or out of it in case it becomes lodged in one of them, provided only that there has been no previous inflammatory process to interfere with the action of the cilia. If the latter, however, do not act, normally, the ovum may be retarded in its progress and may have grown too large to pass through the uterine end of the tube when it reaches it, as most of the diverticula are in the ampulla. This explanation would account for the large percentage of pregnancies found in the outer portion of the tube.

Simple transverse folds of mucous membrane are to be viewed as normal structures and not as evidences of disease. They are to be found as the remnants of pseudo-follicular salpingitis. This condition can be recognized with the naked eye, for the individual folds are much less marked, having become matted together as a result of the inflammatory processes, the folds having become confluent. Nor does Kroemer believe that this condition is due to gonorrhea, because as a consequence of this disease there is a distention of the tube, with obliteration of the tube folds, and the entire wall of the tube becomes smooth, there being no formation of pockets. He states that chronic forms of gonorrheal inflammation show no anomalies of the folds of the tube wall, but that the ovum is retarded on account of the destruction of the ciliated covering. His ideas are based upon the theory that there is a normal stream of fluid passing through the tube to the uterus, that this stream is caused by the action of the cilia, and that, inflammatory conditions checking the stream, the ovum is not carried through the tube. Tubal pregnancies following gonorrheal salpingitis indicate that the process is healing. The ovum is carried partly through the tube because the healing process is not complete. In fact, there is a tendency to view follicular salpingitis as healing process.

Kroemer's description of a single case is very suggestive, but his conclusion rests upon evidence which this case can not give, for we have yet to know the extent and activity of the ciliated lining of the tube in question. He finds these pockets in a tube from a woman 48 years old, and because they appear to be normal he rules them out as a cause of tubal pregnancy. His paper, however, is valuable, as it gives us a better idea of the form of the entire tube than we possessed before. It remains to extend this work, as he himself suggests, to include the study of a great number of other tubes which are believed to be normal. Such a study should also consider the extent of the ciliated lining within the tube.

In my own collection no effort was made at first in the earlier cases to secure histories, but those with clinical histories which bear upon the subject are numerous and may be collected into three groups: those containing normal embryos, those containing pathological embryos, and those containing pathological ova.

In the first group, containing normal embryos, I find records regarding the number of children and their ages in 14 cases. The statement that a long period of sterility occurs before tubal pregnancy is fully borne out.

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| 1. No. 256. The woman was the mother of one child 8 years old.   | 8. No. 667. This was the first pregnancy.  |
| 2. No. 426. The woman had had two children, 13 and 8 years old respectively.   | 9. No. 706. This is the fourth pregnancy after a mechanical abortion 5 years previously and another abortion 2 years previously. |
| 3. No. 456. One child 15 years old.  | 10. No. 728. This was the second pregnancy.  |
| 4. No. 496. Last pregnancy 7 years previously.   | 11. No. 790. Had been married 7 years, but had had no previous pregnancy. Uterine and tubal trouble.                             |
| 5. No. 503. Two children, the younger 3½ years old.  | 12. No. 808. One child 2½ years old.   |
| 6. No. 612. One child 8 months old.  | 13. No. 898. Married 8 years; no previous pregnancy.   |
| 7. No. 657. Had been married twice and had had one child, 17 years old; otherwise had never been pregnant until this tubal pregnancy occurred. | 14. No. 891. One child 3½ years old.   |

In the pathological embryos, the cases in which data are at hand regarding children are:

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| 1. No. 477. Was the mother of a child 1 year old.   | 7. No. 766. Had been married 7 years, this being her first pregnancy.   |
| 2. No. 478. Three children, the youngest 3 years old.   | 8. No. 784. 41 years old, had been married 14 weeks, this being her first pregnancy. No history of venereal diseases, but a chronic inflammation of both tubes with pelvic peritonitis was found. |
| 3. No. 479. Two children and an abortion; pelvic trouble during the last 4 years.   | 9. No. 804. One pregnancy 3 years before.   |
| 4. No. 685. Had been married 7 years, this being her first pregnancy.   | 10. No. 846. Four pregnancies, the last 10 years before.  |
| 5. No. 697. Two children (ages not given) and four abortions. No history of uterine trouble.  | 11. No. 882. Previous abortions.  |
| 6. No. 729. Married 6 years, had had one child and two abortions, with a history of syphilis and probably of gonorrhea. There were marked morphological changes in the tube wall. |   |

In the third group, in which there are no embryos, but degenerated ova, we have the following:

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| 1. No. 367. The woman had been married 14 years and had had 2 children, 11 and 12 years old.                                       | 10. No. 762. Had been married 6 years and aborted during the first year; otherwise never pregnant.  |
| 2. No. 488. Abortion 7 years before.   | 11. No. 777. Had been married twice in 5 years, this being her first pregnancy. Her first husband had gonorrhea. A histological examination of the tube folds showed them to be matted together and inflamed. |
| 3. No. 540. The woman had had one child, 10 years old. There was a history of chronic inflammatory pelvic disease since its birth. | 12. No. 787. Had been married 7 years, this being her first pregnancy. Histological examination showed marked follicular salpingitis.   |
| 4. No. 553. Had had one child, 13 months old.  | 13. No. 794. 29 years of age, had had two children, 5 and 6 years respectively.   |
| 5. No. 570. Had been married 15 months and had had one miscarriage 4 months later.   | 14. No. 815. One child, 9 years old.  |
| 6. No. 686. Had had one child, 11 years old. A history of pelvic inflammation. Tube wall was found inflamed.                       | 15. No. 835. Two children, youngest 6 years old.  |
| 7. No. 720. Had had 7 children (the youngest 4 years old) and 6 abortions, 2 since birth of last child.                            | 16. No. 891. Youngest child 10 years old.   |
| 8. No. 726. Had had one child, 5 months old, and an abortion 3 months after its birth.   | 17. No. 892. Youngest child 7 years old.  |
| 9. No. 754. Had had one child, 5 years old.  |   |

All of these cases in which histories are given point clearly towards a long period of sterility as well as toward infection before the tubal pregnancy occurred. At this place it may be well to cite in greater detail a very good instance bearing upon this point. No. 488 is a specimen from a case of double ectopic pregnancy, in which the tube from the second operation was sent to me. It contained a pathological ovum, 5 mm. in diameter. The woman was married in 1903 at the age of 21 years. The next year she had an abortion performed, after which she was troubled continuously with pelvic attacks, being treated for them and having in

consultation a number of prominent physicians. Five years after the mechanical abortion she was operated upon for appendicitis, at which time it was found that the tube and ovaries were adherent. These were separated by the surgeon, who hoped thereby to bring about a condition to favor pregnancy, as the woman was anxious to have a child. A year later she was operated upon for tubal pregnancy. The other tube was found well matted together and would have been removed, had it not been for the woman's desire to have a child. The following year pregnancy took place in this tube, which contained the pathological ovum mentioned above. Examination of the specimen showed that the folds of the tube had become adherent, forming a follicular salpingitis. This seems to be a clear case in which the trouble may have arisen from the abortion which was performed 7 years before the second tubal pregnancy.

### IMPLANTATION IN TUBAL PREGNANCY.

We have examined with care all the tube walls and as yet have never found any tissue that could be considered as the decidua, nor have we found any specimens of early implantation. Whenever we have encountered an ovum which was very small, it was invariably found separated from the tube wall by a definite layer of blood. It would appear that in these cases some time had elapsed since the implantation, which could hardly be accomplished without attachment of the ovum to the tube wall. For the present we must admit that the trophoblast often fastens itself to one of the folds of the tube and gets its nourishment from the adjacent venous sinuses, for which it seems to have a great affinity. In older specimens the trophoblast has eaten its way into the muscle wall and tapped blood-vessels, from which marked hemorrhages have taken place. In the uterus the formation of the decidua seems to aid in checking the hemorrhage by forming, as it were, a dam between the tips of the villi and eroded uterus upon which the trophoblast feeds, only a little of the blood passing this dam to enter the spaces between the villi. Nor do the trophoblast and syncytium at once become active as a result of the increased amount of nourishment. In general the trophoblast between the villi becomes necrotic and contracts into small yellow spherical masses about 1 mm. in diameter, which in turn are often eaten up by other syncytial cells. It appears therefore that in a normal condition of the chorion and uterus the trophoblast keeps the blood from entering the spaces between the villi. In the tube, however, there being no decidua, implantation must be effected by the trophoblast alone. The tube wall does not respond as actively as does the uterine wall. In the latter case implantation is aided by the production of the decidua. In the tube we must necessarily have more hemorrhage, and in studying the chorion one finds numerous hemorrhages between the villi, forming old blood coagula. The fibrinous substance is formed and the trophoblast makes every effort to implant itself in these clots. So we have a double process. The trophoblast has eaten into the tube wall, and at the same time is attaching itself to the clots of blood which have escaped into the lumen. We have every indication in specimens under 2 cm. in diameter of repeated hemorrhages

into the lumen. They first form a series of clots around the chorion, fresher clots occur between the older ones, and finally there are delicate streams of uncoagulated blood upon which the ovum is nourished. The trophoblast spreads into long strands between the muscle cells of the tube wall and taps fresh blood sinuses. It spreads in old blood clots along fibrin strands, forming streaks of cells, which often extend several millimeters beyond the tips of the villi. Even the best of specimens frequently show such extensive hemorrhage around the chorion and such marked degeneration of the villi that it is a wonder that the ovum continues to grow normally. In fact, in the majority of cases the hemorrhage has rapidly detached it and it begins to degenerate. It collapses and grows in an irregular fashion, and if the specimen is not aborted into the peritoneal cavity it undergoes further and complete degeneration. Were not these specimens removed by surgeons, I think that in many cases spontaneous healing would occur. In some specimens we find a smaller organized clot with a very few fibrous villi scattered through it. Such a condition must be considered as a tubal pregnancy which has healed spontaneously.

#### NORMAL EMBRYOS IN THE UTERUS.

It is now generally admitted that in normal implantation the ovum penetrates the uterine wall and attaches itself within the mucosa. This fact, which was first established by Count Spee, was subsequently confirmed by Peters and other competent investigators. Fairly conclusive evidence was adduced by Bryce and Teacher in the careful study of their well-known specimen. When the ovum first reaches the uterus it rapidly penetrates the mucous membrane and forms a cavity for itself by secreting a substance which destroys the cells, the ovum being encircled by a layer of dead cells. It may be proper at this point to state that this process of destruction is observed wherever the ovum comes in contact with maternal tissue. The cells undergo a curious hyaline transformation and are converted into a fibrinoid mass often spoken of as fibrin; but this mass is compact and not intermingled with individual cells. It is sometimes spoken of as canalized fibrin. The word "fibrin" in this connection is a misnomer, as was pointed out by Professor Grosser, who constantly speaks of this substance as "fibrinoid." If we add to this the word "necrosis," it seems to me that the term *fibrinoid necrosis* would describe the condition as well as our present knowledge warrants.

The entrance of the ovum into the mucous membrane is accomplished, as a rule, by a profuse local hemorrhage into the cavity which the ovum has burrowed out for itself. This is shown especially well in the specimen by Bryce and Teacher (their Plate III) and in a somewhat older specimen by Peters. As all of these observations were made upon specimens with a questionable history, it is not clearly determined whether the hemorrhage is to be viewed as a normal or as a pathological process. However, it seems to me that this question has been fully set at rest by Herzog, who obtained an ovum with normal implantation from a woman who had died from a puncture wound of the heart. We have here a specimen undoubtedly normal in which the hemorrhage is practically identical with that in Peters's specimen. Below the point of implantation there are large sinuses of maternal blood

into which the trophoblast extends, and in turn the blood reaches to the chorionic membrane, filling entirely the small spaces between the villi, which are just beginning. We have here a true intervillous hemorrhage which many often speak of as a primitive intervillous circulation. On the other hand, we have two other young human ova in which there is practically no blood in the intervillous spaces. The one recorded by Jung is from uterine scrapings. The specimen is somewhat older than that of Peters. It was removed with a large mass of uterine mucous membrane attached, so if the intervillous spaces had been normally filled with blood, it is not improbable that it would have run, leaving the empty spaces filled with clear fluid.

The other case is that of Strahl and Beneke, whose specimen was also obtained from uterine scrapings. In this case a number of large vessels and sinuses in the neighborhood of the ovum are filled with blood, but most of the intervillous spaces are empty.

A similar specimen found *in situ* by Frassi establishes the theory that the freshly implanted ovum is not always embedded in a mass of blood. In the Frassi specimen the intervillous spaces were found empty, but in direct contact with the uterine veins. Frassi, however, concludes that this condition does not speak against an intervillous circulation, but rather in its favor; and this opinion is also entertained by Grosser.

In our own collection we have a specimen about the size of Herzog's or Peters's with practically the same intervillous hemorrhage. The specimen (No. 763) is somewhat more advanced than either of the two others; it was obtained from uterine scrapings and appears to be normal in every respect. However, in later stages it does not appear as though the hemorrhage is as pronounced as in some of the earlier specimens studied. In fact, this point has been commented upon frequently, and it is usually stated that the absence of blood between the villi is due to contraction of the uterus when the entire organ is removed at operation or to ruptured intervillous spaces when the specimen is obtained from the abortion. It has always seemed to me probable that in the latter instance the rupture has allowed the blood to enter instead of escape and that in the former it is very remarkable that the contraction of the uterus should have pressed out the blood corpuscles and allowed the blood plasma to remain. At any rate, in older specimens which have been examined *in situ* it is difficult to show that an intervillous circulation exists. Some embryologists have overcome this possibility by stating that intervillous circulation is a condition peculiar to the second half of pregnancy. After examining several well-preserved specimens *in situ*, I am convinced that this question is by no means settled, and must still be regarded as open.

At this point the findings of two excellent specimens may be cited. One is from an ovum and uterus containing a normal embryo 26 mm. long (No. 782) and the other is from a specimen containing an embryo 4 mm. long (No. 836).

In the first specimen the entire uterus was hardened in strong formalin and was carefully cut into slabs, so that the attachment of the chorion to the uterus could be studied to advantage. There was practically no blood between the villi in this specimen and the tips of the villi were firmly attached to the uterine wall.

Between the villi were islands of necrotic trophoblast about 1 mm. in diameter and of a yellowish color. This seems to be the normal process in the development of the chorion, because as it advances there must be an extensive destruction of many of the primary branches of the villi. The condition may be compared to that observed in a dense forest of large trees, in which one can observe all stages of destruction of the branches that can not get sunlight. First, the branches near the main trunk of the tree die and then the larger branches succumb in case their tips do not reach the sunlight. Between the villi in this specimen there were found occasional hemorrhages and some amount of scattered blood. Whenever this blood comes in contact with the trophoblast, it in turn becomes active, for it has something to feed on, but in general the spaces between the villi are empty or partly filled with its degenerating branches, so there seems to be here no question regarding the absence of a normal intervillous circulation; without question, however, an extensive hemorrhage is often present in very early stages and specimens intermediate to those and the one just described are necessary in order to explain the transition from such specimens to those of Bryce and Teacher, Peters and Herzog, and No. 782, just described.

This stage we have in No. 836. The specimen came to the laboratory immediately after the operation, was carefully opened, and fixed alive in corrosive acetic. The specimen came from a young woman who had been married for 4 years, this being her first pregnancy. The uterus was removed for a myomatous condition. There was no history indicating any other disease. It was sent to the laboratory immediately and we succeeded in opening the uterus without injuring the implantation of the mass. The ovum was covered with decidua reflexa, below which tortuous vessels were apparent. On one side the sac (the implanted chorion) was adherent to the uterine mucosa (decidua vera). With a sharp scalpel the entire mass was dissected away from the uterus and brought under a binocular microscope in warm salt solution. The middle portion of the free surface was opened carefully, beautiful young villi being found, and the delicate wall of the chorion was next opened. Within were seen a transparent young embryo, 4 mm. long, and its umbilical vesicle. Through this opening in the chorion warm 40 per cent saturated aqueous solution of  $\text{HgCl}_2$  containing 5 per cent glacial acetic acid was gently introduced and the entire mass placed in 500 c. c. of this fixation fluid. The main body of the uterus was dissected free from the myomatous nodule and fixed in 10 per cent formalin, the site of the implanted ovum being marked with a short wooden rod.

Later on the implanted chorion was cut into slabs and numerous photographs and drawings were made. This gave an opportunity to study carefully the villi and the spaces between them. The block which formed the middle zone of the ovum was about 4 mm. thick. The chorion was composed mostly of sharp white villi, with a small amount of blood at one point near the chorionic membrane; otherwise the intervillous spaces were filled with necrotic tips of villi or with a clear fluid. At the bases of the villi—that is, on the uterine side—the chorion was partly encircled with a hemorrhage which apparently involved the tips of the villi for about one-half of the base. Otherwise the tips had come into contact with the uterus

without producing any hemorrhage. It appears, then, that in the earlier stages there is an extensive hemorrhage, so that there is sufficient blood to fill all the spaces between the villi, but later, as the ovum grows larger, the tips of the villi seem to protect the intervillous spaces by throwing up a wall or dam of trophoblast, which seems to hold back or plug the blood-vessels as soon as they have been eroded. The process is severe and must of necessity be accompanied with hemorrhages, but if these are not too extensive the effused blood can easily be devoured by the adjacent trophoblast. In general, however, this process is marked at the tips of the villi, but not between them. In fact, if there is a large hemorrhage, the ovum is rapidly detached, as is so frequently met with in tubal pregnancy. Sometimes in normal tubal pregnancies there are hemorrhagic areas measuring several millimeters in diameter. These seem to retard the growth of the ovum. If they are small, it appears as though the blood is prevented from forming a coagulum, possibly owing to some inhibitory substance secreted by the trophoblast. When the hemorrhage is large it appears as though this substance can not prevent coagulation, but in the neighborhood of the villi we usually have fluid blood, judging by the morphological appearances under the microscope.

#### NORMAL EMBRYOS IN THE TUBE.

Among the many small ova found in the tube very few contain normal embryos. Either the embryo is deformed (as in No. 729), it is missing (as in No. 754), or the entire ovum is reduced to a small clot (as in Nos. 367 and 539). In these specimens the embryonic mass was either partly implanted or lying free in the tube lumen, showing that in many cases the ovum becomes detached, begins to disintegrate, and if not aborted into the abdominal cavity would ultimately be absorbed. In all probability abortion into the abdominal cavity is a common process, for we frequently see the ovum breaking up into pieces and scattered for long distances in the tube, and in some instances we have remaining a very few fibrous villi in the tube folds as the only indication of a pregnancy (plate 2, fig. 2).

If the pregnancy takes place in the uterine end of the tube, the ovum seems to find a better lodgment—that is, it becomes implanted in the muscle wall and frequently eats through it. This is usually the case in an early perforation, for instance, in No. 729 (plate 10, fig. 3) the implantation was near the uterus, possibly at the attachment of the broad ligament. This burrowing into the tube wall could readily cause a perforation. If, however, attachment takes place on the broad-ligament side of the tube, perforation is less likely to occur immediately, but when it does occur it is into the broad ligament. This is easily understood, because it is only in this direction that the chorion can find sufficient tissue for a firm attachment. Such is the case in specimen No. 790, which contains an embryo 20 mm. long. Here there was such an extensive mixing up of the tissue that the specimen was at first believed to be one of ovarian pregnancy; more careful study, however, showed that it was a tubal pregnancy which had ruptured into the broad ligament.

We have in our collection one exceptionally good specimen of a tubal pregnancy containing a very small normal embryo. In this specimen, No. 808, the tube is uniformly distended for a distance of about 50 mm., having a diameter of about 15 mm. A good reconstruction of this specimen, after it had been cut into numerous sections, showed that the ovum was implanted on the broad ligament side near the uterine end for a distance of about 15 mm. and extended into the tube lumen towards the uterus for a distance of about 10 mm. and towards the abdominal end of the tube for about 40 mm. The tube lumen on the uterine end seems to be perfectly normal, and at the point of implantation it passes around the ovum on the side opposite the broad ligament. Opposite the middle of the attachment the outline of the tube is not very sharp, most of the tube wall having disappeared; its outer wall portion is only partially covered with epithelial cells. At this point the space between the ovum and the tube is distinguished by a layer of trophoblast covered by a large plug of necrotic tissue. This extends more or less around the circumference of the ovum until it reaches the point where the pregnancy mass has broken into the tube lumen. From here on the tube is lined with numerous well-formed folds which are more or less separated, probably owing to the distention. Beyond the pregnancy mass, within the inner opening of the tube, the lumen is filled with large, well-formed folds of mucous membrane. Between them there is a small plug of necrotic tissue, belonging to the ovum, but not adherent to the folds. To all appearances we have here a perfectly normal tube wall without any indication of inflammation or any clinical signs of any infectious disease. For some unknown reason the ovum became lodged in the tube, burrowed into the tube lumen in both directions—that is, towards the uterus and towards the abdominal wall. Considerable change has taken place in the ovum, as it can hardly be considered normal for this stage of development. The coelom is very small in a transverse direction and has become elongated to correspond somewhat with the shape of the surrounding clot. The embryo is located in the implanted region, but the ovum is drawn out into the clot on its distal side, being fairly well constricted in its middle; that is, there seems to be a tendency for the chorion to be divided into two parts. The inner part contains the normal embryo, and the outer a small isolated body which seems to be a part of the umbilical vesicle. At any rate, the structure is identical with the umbilical vesicle, but it is not connected. So far as external form is concerned the embryo appears to be normal. The organs are sharply defined and the surface is beautifully molded. Sections show that the embryo is normal, except the ventral half of the thoracic spinal cord, which has become dissociated. (See plate 1, fig. 4, and plate 11, figs. 3 and 4.)

#### THE TROPHOBLAST.

The villi of the chorion of No. 808 are unequally divided. On one side, near the tube lumen opposite the implantation, the bare chorionic wall is separated from the lumen by the necrotic plug spoken of above. Opposite this, near the broad ligament, a large tuft of villi reaches into the tube on the uterine side and is well implanted. In the distal end of the clot most of the villi are degenerating; but



strands of trophoblast remain intermingled with leucocytes and fibrin. The mesoderm of the villi forming the tuft appears to be normal and contains within it blood vessels filled with blood from the embryo. The tips of the tuft of villi are filled with great masses of active trophoblast, which often radiate in strands to the tube wall and invade it. These are accompanied in places with fibrinous strands, which are more or less filled with leucocytes. Many of the villi are encircled with lakelets of blood which contain no fibrin, indicating that it is not coagulated. It seems as though the trophoblast secretes some substance to prevent coagulation. At points the cells of the trophoblast and of the tube wall are so intermingled that it is practically impossible to make a separation; the trophoblast cells, however, surround the small lakelets of blood, producing an appearance of cavernous tissue. This is especially well marked at the tips of the villi. It appears as though the trophoblast has tapped all the veins of the tube wall, and because there is no formation of a decidua it is impossible for the wall which is thrown up to prevent excessive hemorrhage. We have here a true intervillous circulation which, if not arrested, is bound to destroy the ovum. In this specimen, as in all the rest, there is no decidua. In fact, to describe a decidua in them would be a stretch of the imagination. Within the tube wall there are numerous leucocytes, just as we have in a normal implantation.

We can here describe several varieties of trophoblast:

(1) The ordinary kind composed of quite uniform cells stacked upon the tips of the villi.

(2) The longer streams of trophoblast which radiate from the villi throughout the clot and along the fibrin bands which are also present.

(3) Trophoblast cells scattered either within the muscle wall of the tube or through the clot or upon the surface of the clots. These are no doubt the cells pictured by Bryce and Teacher in their Plate VI. However, these writers are of the opinion that these are decidual or maternal cells, but they occur with much regularity at the tips of the villi where they come in contact with the clots. They spread first from the villi as solid strands and, as they spread, the cells become separated, but do not come in contact with maternal tissue. They are like the pickets in advance of an army. First they appear in every respect like trophoblast cells, and, as they are always connected with them, I think the statement is warranted that they belong to the trophoblast and are in no respect decidual. The fact is that decidua can not be demonstrated in tubal pregnancy, unless indeed we describe the trophoblast as such. This point, however, can not be determined when the trophoblast cells have invaded the maternal tissue.

(4) The syncytium seems to be present where there is great activity.

(5) A peculiar kind of syncytium which forms a network, or, to describe it better, is vacuolated. There are all stages of gradation between the solid and vacuolated varieties. The large masses of solid trophoblast usually appear to be located upon the villi. These run out into the processes which radiate in all directions, encircling other fresh blood cells. At about this stage of development numerous clear vacuoles are seen in the solid mass of syncytium. These become larger and larger,

blending with the processes of adjacent syncytium, thus forming a curious network as shown in plate 1, figure 3. This type of trophoblast seems to be most pronounced where there is great activity, *i. e.*, when the tube is being eroded. It appears to throw up a dam to prevent excessive hemorrhage or to engulf the blood escaping from the freshly tapped blood vessels. In fact, the vacuoles are filled partly with healthy, partly with disintegrating blood corpuscles, and partly with a clear fluid. The dam thus thrown up makes a sieve through which the blood percolates on its way to destruction. Is it not probable that in this way pabulum is formed for the ovum? (See plate 1, fig. 4.)

The vacuolated syncytium seems to be identical with the variety of trophoblast called plasmodium by Bryce and Teacher. This is well shown in their Plate V. It can also be recognized in the illustration by Peters; for example, in his figure 14, Plate VI, and again by Jung, figure 19, Plate VII.

In the lakelets between the large strands of syncytium the red blood corpuscles are well formed and sharply defined, but as the blood comes in closer contact with the trophoblast we see all stages of disintegration. They break up into small granules, the finer of which do not stain so intensely as blood and often run together in large masses, which sometimes in the neighborhood of syncytium are easily confused with it. Many of the granules in properly stained specimens are intensely red, much more so than normal corpuscles. These may be seen within the protoplasm of the syncytium and sometimes within the vacuoles, and often within ordinary trophoblast cells. The minute granules, which stain intensely red, vary in size, but are usually about as large as the chromatin of the nuclei, though they often fade off into the ultramicroscopic. Especially is this so in the neighborhood of the masses which are easily confused with the syncytium. It appears, then, that the corpuscles first break down into intensely staining granules, which are partly taken up by the cells and partly undergo further transformation in a homogeneous mass. The description here given rests upon specimens which have been counterstained in eosin, aurantia, and orange G, one of which is shown (plate 1, fig. 4).

The chorionic wall in No. 808 is for most part quite thin and at points it seems to be ruptured. In the region of the embryo the mesoderm of the villi is quite normal, being composed of delicate fibrillæ arising from the tips of the multipolar cells. Scattered throughout this tissue are numerous large cells with a delicate protoplasm, which usually takes on some of the counterstain. These are the Hofbauer cells, so frequently seen in pathological villi. Some distance from the embryo the villi are mostly fibrous and are undergoing all sorts of degenerative processes; that is, they are dying.

The coelom is long drawn out and fully constricted at one point to correspond with the shape of the chorion. In the neighborhood of the embryo it is entirely filled with the amnion, but in the small spaces between the amnion and the chorion is a granular deposit containing numerous maternal red blood corpuscles. As these are embedded within this granular mass, they must have lodged there while the specimen was still living. There are also numerous nucleated cells in this region which appear to have wandered from the embryo.

There are also two varieties of magma found within the coelom. On the uterine side of the embryo is a peculiar flaky granular magma which takes on a blue tinge in hematoxylin. The larger flakes are stratified and show alternating lighter and darker zones encircling a central highly stained granule. Occasionally this type of magma is found in other specimens, but the flakes are often very irregular and some of them stain intensely with hematoxylin. On the outer side of the embryo the coelom is filled with a dense reticular magma. Within this is a large space containing the isolated yolk sac spoken of above. The fibrillæ of the magma stain intensely in the Van Gieson stain.

In sections made in this way it is clearly seen that the magma is composed of a dense network of fibrils. This network reaches through the chorionic membrane to this epithelial covering and bears a distinct relation to the mesoderm cells; in fact it belongs to them. As the mesoderm cells do not always form any marked border around the coelom, but reach into it, they carry with them a denser network of fibrils, showing that the protoplasm immediately around the nuclei is composed of very highly differentiated magma fibrils. In other words, magma fibrils are coming out from the cells of the mesoderm and projecting into the ovum. This observation is fully verified in the pathological ovum of No. 402, in which the individual magma all arises from the mesoderm of the chorion and radiates into the cavity of coelom. In the pathological magma of this specimen the fibrils are as highly differentiated in the coelom as are those immediately surrounding the nuclei in the normal specimen, No. 808.

The necrotic plug between the ovum and the tube wall is very pronounced. It is about 1 mm. thick and 2 mm. wide. Towards the distal end of the tube it thins out and it is probable that this thinness occurs at the point of rupture of the ovum from the tube wall into the tube lumen. The plug itself is stratified, as it is composed largely of fibrils. To the naked eye it appears like a lens. No doubt it represents a similar plug which is formed in the uterus when the ovum implants itself normally.

#### NORMAL EMBRYOS 6 TO 9 MM. IN LENGTH.

To all appearances the ovum of the embryo, 4 mm. long (No. 808), is well attached to the tube wall, but it is impossible to state definitely whether the attachment is normal or even whether the ovum is normal, as I do not possess suitable stages which have been studied from this standpoint for comparison. One thing, however, seems to be evident, namely, that there is an excessive amount of blood between the villi of the chorion and that the shape of the chorion is normal. The specimens succeeding this (Nos. 706, 612, 597) contain embryos apparently normal, ranging from 6 to 9 mm. The external form of the embryos appears to be normal, but only one of these (No. 612) was cut into serial sections. In general the embryos of these specimens have been more or less injured, which makes it difficult to pass upon their normality. In all three of these specimens the chorionic wall is very hemorrhagic. In the first specimen (No. 706) the hemorrhagic mass is the size of a walnut. It contains within it an amniotic cavity just large enough to hold

the embryo, which is 6.5 mm. long. The villi of the chorion show marked degenerative changes, but at some points the trophoblast is active. The chorionic wall appears to be somewhat fibrous, but is rich in blood-vessels. In the sections the exocoelom contains a dense reticular magma through which both embryonal and maternal blood cells are scattered. Upon the wall of the chorion are several dense plaques of trophoblast, more especially evident at places where the chorion comes in contact with fresh blood. We have here a specimen which to all appearances is pathological. The hemorrhage is so extensive, the blood clot is so thoroughly organized, and the amniotic cavity is so very small, that it is surprising that an embryo, normal in appearance, should be found within it. Most of the tissues are quite active and certain groups of trophoblast cells appear to be normal; otherwise, the villi are degenerating. It appears, then, that only a few villi are necessary to nourish the ovum properly.

In the next specimen (No. 612), the changes of the chorion are not so pronounced. The chorionic wall is very vascular and unusually fibrous for one containing an embryo so small. The amnion is also well formed and in apposition with the chorion. The villi are well developed and upon their tips is a very extensive trophoblast. At some points are large areas of vacuolated syncytium. The trophoblast comes in close contact with the tube wall and is partly separated from it by remnants of its epithelial lining. To all appearances the implantation is normal with an exceptionally large amount of organized blood clot between the chorion and the tube. We have here an excellent example of an ovum, well nourished despite the fact that the intervillous spaces are entirely plugged with blood clot. The villi have perforated this clot and are well attached to the tube wall. The clot is stratified, that is, it is composed of alternating layers of fibrinoid tissue and blood, and it is also well infiltrated with leucocytes. At points where the villi are dying the leucocytes form large colonies. The trophoblast within the clot has also a peculiar appearance, the great amount of hyaline matter between the individual nuclei making it look like cartilage. At any rate, the changes are so pronounced that we can not possibly look upon the clot between the villi as forming a normal circulation. We have really a red infarction through which the villi extend to get their nourishment from the tube wall.

Specimen No. 597 contains an embryo 9 mm. long, which appears to be normal. It is encircled by a narrow zone of blood which is not organized, but within which there are many necrotic villi. There are also marked signs of inflammation and a little active trophoblast. There is some vacuolated syncytium, undergoing necrosis. It is quite difficult to understand why a specimen like this should contain a normal embryo. Possibly the embryo had been dead for some time, as its tissues are soft and there were extensive necrotic changes in the chorion. We appear to have here, in the specimens just described, stages of degeneration of the ovum with embryos up to 10 mm., showing partial or complete destruction of the chorion and the ultimate death of the embryo. The embryo 4 mm. long was undoubtedly alive at the time of the operation, and the embryo 9 mm. long was undoubtedly dead. Between these two extremes we have a gradual increase of the amount of blood

between the villi, which ultimately detaches the chorion from the tube wall and causes the death of the embryo. This condition, which should be viewed as a true intervillous circulation, seems to prove fatal for the embryo. In the tube such a condition must end in the destruction of the ovum and in the uterus in an abortion. Unless the activity of the trophoblast is sufficiently pronounced to destroy the masses of blood which become lodged between the villi and at the same time prevent further hemorrhage into these spaces we can hardly expect a normal implantation.

From all appearances the development of the chorion of No. 612 is such that we could have expected the further development of a normal embryo in case the tube had not been removed by the surgeon. There is a beautiful, active, vacuolated syncytium which forms a pretty complete wall around the intervillous clot. This wall is sufficiently solid to prevent any great amount of new blood from entering these spaces. The trophoblast is growing in among the muscles of the tube wall and it is also to be seen in many of its blood-vessels.

#### NORMAL EMBRYOS OVER 9 MM. LONG.

A more advanced stage is seen in a similar specimen (No. 109) which contains an embryo 10.5 mm. long. This also shows a considerable amount of blood between the villi, but most of it seems to be fresh. A portion of the clot is stratified, but the rest does not show any marked signs of coagulation. Part of the stratified clot has within it a group of leucocytes. The chorion appears to be normal, and where it comes in contact with the tube wall its trophoblast is extremely active. It forms a wall which prevents further hemorrhage from the vessels of the tube into the intervillous spaces. Various stages of this process are shown in the figures of this specimen. In plate 1, figure 2, the trophoblast within the sinuses is shown. Most of the endothelial lining of the veins has been destroyed, but part still remains, as shown in the figure. An earlier stage of this process of destruction of the wall of the blood vessels is shown in plate 1, figure 1. Here are found all stages of trophoblastic development, from the tips of the villi to the free cells within the blood vessels. A somewhat more advanced stage is shown in plate 1, figure 3. The wall of the venous sinus has been completely destroyed and in its place are strands of trophoblast. Between the lumen and the villi is a pronounced vacuolated syncytium partly filled with blood. This specimen illustrates beautifully the dam thrown up by the trophoblast to prevent hemorrhage from the open veins. The blood between the villi is well encircled with trophoblastic cells; at some points the leucocytes have invaded it. A large clot, which is about 15 mm. long and 2 to 5 mm. thick, separates in part the chorion and the villi from the tube wall. On the chorionic side it is covered with an incomplete layer of trophoblastic cells, as shown in plate 4, figure 3. These seem to be invading the blood clot. Individual cells are often found far from their main strand, as shown in this figure. Undoubtedly we have here a clot of blood which the trophoblast is attempting to destroy. There is no indication of fresh hemorrhages in any of the sections. The trophoblast is extensive and vacuolated, forming a wall which protects nearly all of the intervillous spaces.

An even more perfect specimen of implantation is possibly that of No. 670. The embryo in this case was 12.5 mm. long and the spaces between the chorionic wall and the tube wall are largely empty. There are, however, several hemorrhagic areas about 5 mm. in diameter. Where the villi come in contact with these there is a marked layer of fibrinoid necrosis, a sample of which is shown in plate 2, figure 3. It appears as though this substance may arise from all kinds of tissue, either maternal or embryonal. In the figure just referred to it seems to rise from degenerate trophoblastic cells. In this case we seem to have the reverse of the process shown in No. 109. There the trophoblast is destroying the blood clot. Here the blood clot is surrounding the zone of necrotic tissue which is composed partly of trophoblast. Elsewhere in this specimen are large strands of this fibrinoid substance, which often reach into the tube wall. In general, however, the trophoblast is extremely active and markedly vacuolated. Where the trophoblast is heaped up into large islands, their centers are often necrotic, forming yellow nodules, which in turn are being invaded by vacuolated syncytium. This condition is often seen in uterine implantation and has been described and pictured by Grosser. Undoubtedly we are here dealing with the normal destruction of less-favored villi. Adjacent to one of these masses are several villi, which are being invaded by their own trophoblast. This condition is very pronounced in this specimen and is well illustrated in plate 2, figure 7. In this same figure numerous Hofbauer cells are seen. It would seem possible that these Hofbauer cells are free trophoblast cells within the mesoderm of the villus, an opinion already expressed by me in my paper on monsters. As in No. 109, we have here a beautiful case of successful implantation in the tube. There are but few hemorrhages in the intervillous spaces, the trophoblast is extensive, and the villi appear to be normal. In this case we also have a normal embryo. In contrast with these two specimens, No. 535 contains a normal embryo 11 mm. long, and shows an extensive intervillous hemorrhage. There are some slight changes in this embryo; the branchial arches are partly obliterated, and the body wall is sufficiently transparent to allow the ribs to be seen, so that in all probability the embryo was dead before the tube was removed. In this case the tubal mass is very large, about 55 mm. in diameter, and the tube wall is thick, dense, and hemorrhagic, measuring about 15 mm. Within this hemorrhagic mass all stages of degeneration of villi can be noted; plaques of white necrosis alternate with fresh hemorrhages. Scattered through the mass are strands of leucocytes encircling the ovum—that is, at its juncture with the tube wall, a marked infiltration with leucocytes can be noted. The inflammatory process is quite extensive and the necrosis of the villi and its trophoblast is quite complete. We have here an example of the effect of intervillous hemorrhage upon the ovum. It appears to cause its destruction.

The next older stage, which seems to be of value as regards the nature of implantation, is seen in an embryo 17 mm. long (No. 676). This appears to be normal and the ovum had been peeled out of the tube before it came to us, so that it was impossible to make a careful examination of the tube wall in its relation to the villi of the chorion. We determined that the embryonic cavity was lined with a clot and sections of this clot show that it was perforated with normal villi which were

covered with an extensive trophoblast. None of the sections, however, showed the trophoblast in its relation to the tube wall. The only definite point gotten from this specimen is that we have a normal embryo in an apparently normal chorion which has been peeled out of a hemorrhagic bed.

There are three good specimens with embryos, ranging around 25 mm., in which the implantation of the ovum can be studied to advantage. The first (No. 790) contains what may be regarded as a normal embryo about 20 mm. long. This specimen was no doubt alive at the time of the operation, and its surface had been attached to the side of the embryonic cavity by means of a stitch. The attachment of the umbilical cord had not been destroyed, so that it was relatively easy to get suitable serial sections. The wall of the cavity is somewhat hemorrhagic; it contains numerous hyaline necrotic patches and has attached to it the tips of the villi. There is a marked inflammatory reaction. The villi of the chorion are fibrous and tipped off with trophoblast, which often form masses with necrotic cores. The trophoblast enters the tube wall and there is diffused among the muscle bundles. It often encircles and permeates the venous sinuses. The accompanying strands of cells show a considerable amount of hyaline degeneration, which gives to the sections a cartilaginous appearance. Here we have a peculiar attachment of the trophoblast without any marked intervillous hemorrhage.

No. 657 contains an embryo which appears to be normal. It measures 25 mm. in length, is unusually white, and has a very delicate umbilical cord, which may have been injured at the time of the operation. The entire mass has been preserved in formalin, which did not penetrate to the embryo very quickly, a fact that may account for its appearance. Otherwise, the specimen seems to be normal. The amniotic cavity is especially well defined and sections of the chorionic membrane show a normal structure. The spaces between the chorionic membrane and the tube wall are filled with a spotted mass composed of old fibrous strands and fresh hemorrhages. The villi traversing this zone are largely necrotic, but some of them appear to be perfectly normal. The trophoblast covering some of these villi is active, but as the muscle wall of the tube has for the most part been destroyed, it has had no place to implant itself. It seems to have found nourishment in fresh hemorrhages right under the tube wall. At any rate, at this point the trophoblast is active and appears to be normal. Most of the hemorrhagic mass is filled with necrotic villi, showing that an intervillous circulation, when present, strangulates the villi. Only a few of those which perforate this mass freely and have an opportunity to grow again on the tips seem to survive. These no doubt are the ones which have served to nourish the embryo (plate 7, figs. 1 and 4).

The last specimen of this group (No. 183) contains a normal embryo, 28 mm. long. In general the relation here is identical with that found in No. 657. There is a large quantity of fresh blood between the chorionic membrane and the muscle wall of the tube. The space, which is here distended to a maximum, contains dead villi and large necrotic masses of trophoblast. At certain points tufts of the villi pass through this mass and reach the tube wall. Here the trophoblast is very active and vacuolated and ramifies among fresh blood. The tissue of the folds of the tube

wall which also enter the clot are also dissociated; that is, they disappear by histolysis. At another point a tuft of villi reaches to the tube wall and there the trophoblast cells mingle with the tissues of the tube wall. At their tips is an extensive vacuolated trophoblast, the lakelets of which are partly filled with fresh blood. No other specimen better demonstrates that the trophoblast feeds upon a small quantity of fresh blood, but that a large quantity of older blood can not be assimilated by it. It attacks such clots as do the leucocytes. It is only when the trophoblast receives small quantities of fresh blood that we can view its relation to the tube wall as normal.

The last specimen, containing a normal fetus, whose implantation I have had an opportunity to examine, is No. 484. It contains a fetus 96 mm. long. The placenta is partly filled with a large hemorrhagic mass, within which many villi are necrotic. Between these masses there are tufts of villi, often 20 mm. in diameter, which reach to the tube wall and are intimately connected with it. At the point of juncture between the trophoblast and the tube wall is a considerable amount of fibrinous tissue. This the trophoblast invades or perforates and reaches to the blood vessels of the muscular layer, which are tapped, so that we have long strands of trophoblast reaching from the tips of the villi to the blood vessels; but here also there is very little blood between the villi. Between the villi in this region are numerous masses of necrotic trophoblast that have largely undergone fibrinoid degeneration; otherwise we have here a picture practically identical with that obtained from the uterus at like stages of development. It does not differ materially from the condition shown in Grosser's figures 124 and 131, from specimens a little older than No. 484.

#### CONCLUSIONS REGARDING NORMAL IMPLANTATION.

The conclusion drawn from the study of normal implantation in the tube is that in the early stages most of the ova are destroyed by the hemorrhage which is produced for their nourishment. If the dam built up by the trophoblast is sufficient to check the flood in part, enough villi will remain to nourish the ovum. Throughout development such a catastrophe is imminent, and we may have a destruction of the ovum at any time. When the tube ruptures into the broad ligament, the space for the chorion becomes sufficiently large for new villi to grow and attach themselves. If there are enough of these, an occasional hemorrhage will not impair their development. In all cases the ovum within the tube is at a decided disadvantage because it does not have a decidua to aid in producing a normal implantation. Whether this point is of much importance in the second half of pregnancy can not be answered at present. I am rather of the opinion that the decidua is of the greater moment at the beginning of uterine pregnancy.



## PATHOLOGICAL EMBRYOS IN TUBAL PREGNANCY.

It is probable that a number of the normal embryos, in the specimens just described, are slightly deformed and at the beginning of pathological changes. Since the standard of normality had not been fully established, it is practically impossible at present to decide as to what is a slight abnormality. It is only when the change is very pronounced that we recognize embryos as pathological, and for this reason the two groups now under discussion are probably inaccurate. When we understand this subject better, no doubt a larger percentage of the normal group will be transferred to the pathological group, and the same is true regarding the group said to contain no embryos. The method of examination I employed is partly responsible for this. To cut a large number of greatly distended tubes into serial sections in order to determine this point is practically out of the question. However, when the pregnant tube is hardened *in toto* and cut into slabs about 5 mm. in thickness, it is quite easy to detect the remnant of an embryo in case it is lodged within a free amniotic cavity. If, however, the cavity of the chorion is filled with blood, the embryo may be so obscured as to be overlooked, and in several specimens falling under this group the embryo was found accidentally in the sections after it had been overlooked with the naked eye. Nevertheless, speaking from a somewhat wide experience, I think it unlikely that as large a percentage of specimens will have to be transferred from the group containing no embryos to that containing pathological embryos as from the group containing normal embryos.

TABLE 4.—Group containing pathological embryos arranged chronologically.

No.	Mass.	Embryo.	Remarks.	No.	Mass.	Embryo.	Remarks.
196	50×30×30	2.5		567	55×30×25	5	3 weeks. (?)
307	40×40×40	20		685	70×60×50	12	6 weeks. (?)
314	.....	24		697	55×30×30	3.5	4 weeks. (?)
324	45×45×22	3.5		729	20×10×10	8	25 days.
342	30×30×30	5		766	55×45×40	10	7 weeks.
398	40×28×20	2	31 days.	784	75×35×35	5	30 days.
477	.....	5	45 days.	804	50×40×40	( <sup>1</sup> )	
478	85×80×45	22.5	10 weeks. (?)	838	25×25×25	6	3 weeks. (?)
479	90×70×70	80	14 weeks.	846	85×40×48	8	
524	70×60×50	14 (?)		881	110×35×35	3	4 weeks.
554	50×20×20	1		882	60×45×45	8	12 weeks.

<sup>1</sup>Dissociated completely.

As it can readily be seen that specimens can be picked out of this group and arranged according to the length of the embryos, we shall discuss them in this order, considering only those in which the material has been cut or in which the specimens have been worked up with a great deal of care. It follows, then, that the higher numbers are to receive more consideration than the lower numbers.

Four specimens contain embryos less than 5 mm. long. The first of these (No. 324) contains a deformed embryo, 3.5 mm. long. The amniotic cavity is somewhat distended, the umbilical cord is short or lacking entirely, and the chorionic

wall is well formed and contains a few long, slender villi ramifying in the blood clot. The trophoblast is scanty, but there are a few small knobs of syncytium upon the main wall of the chorion. It appears as though the ovum had become gradually detached and that its nourishment was gradually cut off, so that it ultimately resulted in a stunted embryo. We have here a repetition of what is often seen in ova expelled from the uterus. A stage less advanced than this, in fact intermediate between that in No. 808 and that in No. 324, is found in specimen No. 396. The tissue is unusually well preserved and the chorionic mass was cut into serial sections. According to the clinical history, the duration of pregnancy was 31 days. The relation of the chorion to the tube wall is practically identical with that in No. 808. The ovum is small, the villi are reaching out in tufts and radiating through an extensive freshly formed blood clot to implant themselves well in the tube wall. However, in one respect the two specimens are markedly different. In No. 396 the chorionic vesicle contains the remnant of a deformed umbilical vesicle and a small remnant of an embryo, as shown in plate 5, figure 1. Between the umbilical vesicle and the chorionic wall is a considerable amount of reticular magma with patches of maternal blood. The chorionic wall itself is fibrous, thickened, and contains numerous irregular blood vessels filled with blood. Some of the villi reaching out toward the chorion have likewise undergone fibrous degeneration. Although the trophoblast is very active, numerous long strands of cells radiate from it through the blood clot. In many instances these cells are undergoing degenerative changes. There also seems to be fresh hemorrhage encircling the trophoblast. It may be that the implantation was disturbed and the nourishment of the embryo was effected thereby. We have repeatedly observed that the most susceptible parts in young ova are the embryo and amnion, the umbilical vesicle being more resistant. This is emphasized again in this specimen, in which the embryo is more markedly affected than the umbilical vesicle. No doubt if this specimen had continued for some time, it would have become like the one containing the remnant of an ovum embedded in a large mass of organized blood; that is, if the tube had been removed at a later date the specimen would have fallen into group No. 3, which is to be discussed presently.

The two remaining specimens of this group, No. 554 and No. 697, may be considered together, as they exhibit practically the same changes. In the first the chorionic wall and its villi are very fibrous and completely separated from the uterine wall. Many of the villi are necrotic. The coelom contains granular magma and a remnant of an embryo measuring about 1 mm. in length. It is composed of round cells, but it is impossible to determine the outline of any of the organs.

In the second specimen (plate 7, fig. 5) the ovum is more fibrous, that is, the chorion is more fibrous and its cavity contains a nodule of round cells looking much like a section of lymph gland. Strands of trophoblast pass through a very large blood clot and some of it is still connected with the tube wall. At one point the syncytium is vacuolated and enters some of the venous sinuses.

This group taken together gives about the following story: If the ovum is detached early, the embryo first disintegrates and ultimately the umbilical vesicle

is also destroyed, leaving only the wall of the chorion, which becomes strangulated and necrotic and is finally lost in the blood clot. If the ovum implants itself well, so that the embryo can get a start, we have a different story, as is shown by specimens Nos. 324 and 697. In the first the embryo is round and stunted, and in the second a later stage is represented; the embryo has almost entirely disappeared, repeating again conditions found in pathological ova in the uterus.

The first specimen of the next group is No. 567, which contains a dissociated embryo 5 mm. long. At first we believed this embryo to be normal, but serial sections soon showed that it had undergone decided changes, most of its tissues being dissociated. However, it was still possible to locate the organs in it. The chorionic wall is thin and contains numerous slender villi which radiate through the well-organized clot, some of them reaching to the tube wall. Upon these are found occasional masses of active trophoblast containing vacuolated syncytium. These clusters are feeding upon fresh blood. They do not seem to be sufficiently numerous for the proper nourishment of the embryo. At any rate there are so many necrotic villi among the normal ones that one is led to believe that the nutrition of the ovum is impaired. There is also a marked infection in this case. A tuft of vacuolated syncytium, invaded by leucocytes, is shown in plate 2, figure 5. Either the faulty implantation or the infection would be sufficient to account for the death of the embryo.

In the three following specimens, Nos. 477, 784, and 838, the embryos are markedly deformed, so that the process must be regarded as being further advanced than in the one just described. No. 784 contains an embryo that is markedly deformed, but can hardly be considered normal. The chorion is completely separated from the tube wall, but within this mass of blood is considerable active trophoblast, together with a large number of necrotic villi. The tube has been practically eaten through and there is a very active inflammation in its wall and lumen. In No. 838 it appears as though the chorion has become entirely detached by a sudden hemorrhage; the blood clot around it is more uniform than usual, as a tuft of villi was protruding from the clot when it arrived at the laboratory. Much of the trophoblast is active, but a great many of the villi are degenerated. It appears as if the villi are being compressed into a single mass. The embryo within (plate 11, fig. 2) is very much deformed. The tissues are markedly dissociated, so much so that the central nervous system and many of the organs can hardly be recognized.

In the last specimen of this group, No. 342, the chorion is fibrous and contains a thickened amnion. The umbilical cord is of the normal size for an embryo about 10 mm. long, and upon its tip rests a small nodule containing a cavity. No doubt this is all that is left of the embryo (plate 5, fig. 2).

After the embryo attains a length of about 5 mm., affections of the ovum in the tube seem to influence it much as in the case of pathological ova from the uterus. The embryo does not disintegrate so rapidly as is the case in younger specimens, but its tissues become dissociated, finally run together, and in this way produce atrophy of the embryo. The beginning of this change is beautifully illustrated in No. 567 and the end of it in No. 342.

The specimens containing embryos from 8 to 14 mm. are easily brought together into a single group, with the exception of No. 729 (plate 10). The tube wall and the chorion of this specimen have every appearance of being normal. The embryo was not found, but judging by the degree of development of the cord, it is estimated that the escaped embryo must have been about 8 mm. long. The remaining specimens of this group usually show markedly hemorrhagic chorionic walls. The first specimen of this group (No. 524) contains an embryo 14 mm. long. The ovum contains a cavity about 25 mm. in diameter, which is encircled by a wall 15 mm. thick. The wall is composed of an organized clot ramified by numerous necrotic villi. There is some irregular or active trophoblast upon the villi, but in general it does reach to the tube wall. There are also signs of extensive inflammation. The chorionic wall is fibrous, the amnion is well developed, and the umbilical cord appears as though the specimen might contain a normal embryo. In many respects the chorionic wall appears much like that of No. 535, which contains a normal embryo.

In the next case (No. 685) the amniotic cavity is practically obliterated, but it contains within a dissociated and macerated embryo. In general the chorion is entirely separated from the tube wall. It contains no active villi. A similar process is seen in No. 766, but the wall of the chorion seems more fibrous, and in general the chorion is detached from the tube wall. An earlier stage of reaction, like the one just given, is found in No. 846. The dissociation of the embryo is not quite so marked and the hemorrhage around it seems fresher. Practically all of the villi are necrotic and the wall of the ovum is fibrous and has a single active mass of trophoblast upon it. Complete destruction of the embryo is well illustrated in No. 804. The chorion here is destroyed entirely, only a faint outline of the villi remaining. The cavity of the ovum is entirely filled with a homogeneous mass of cells representing the embryo. In other words, the dissociation is complete.

We have in this group all stages of the destruction of the embryo, beginning with what appears to be the normal embryos (Nos. 729 and 724) and ending with complete destruction, as in No. 804. It is quite clear that this destruction is due to extensive hemorrhage between the villi, which ultimately detaches the ovum and causes its strangulation.

There are four specimens in the collection containing pathological embryos over 20 mm. long. In two (Nos. 307 and 314) marked changes have taken place in the embryo. The first is thoroughly dissociated and the second, in addition to this dissociation, is small and atrophic. It resembles the embryo in No. 478, although it is not quite normal in form. It is one of those border-line cases in which it is difficult to determine whether the embryo is normal or pathological. The examination of the chorion in this case was not extensive, but it was sufficient to show that most of the villi were necrotic. There are 3 normal embryos between 20 and 28 mm., and an equal number of pathological ones in our collection, showing that about half of the embryos succumb after they reach this size. Beyond this are 8 normal embryos ranging from 35 to 96 mm. and 1 specimen (No. 479) which contains a pathological embryo 80 mm. long. This remarkable specimen consists of a ruptured tubal pregnancy with a protruding fetus, whose tissues are edema-

tous, one foot being swollen more than the rest of the body. Evidently the fetus had been dead for some time. The secondary changes observed in this specimen are best accounted for by an impairment of circulation. The fetus is adherent to the chorion by a band of tissue, which reaches from the chorion to the neck. It is one of those secondary bands occasionally observed in pathological embryos. The tissues of the chorion are also edematous, the mesoderm of the villi being more or less destroyed. Remnants of blood-vessels are left, but contain no blood. There is some hemorrhage between the villi, but in its neighborhood the trophoblast is not active.

### PATHOLOGICAL OVA IN TUBAL PREGNANCY.

Under the two previous headings, ova with normal and pathological embryos were considered; the first in order to make comparison with normal uterine implantation; the second, in order to describe the preliminary destructive changes after the ovum has been normally implanted in the tube. In this way only has it been possible for me to consider, in any sort of a connected fashion, tubal pregnancy containing pathological ova. Were it possible to describe the very earliest stages in the tube, it would not be necessary to resort to the cumbersome and inverse method employed in the present description. With the pictures of normal and pathological ova in the tube and uterus clearly before us, we can make something of the earlier specimens, in which implantation was not properly effected or, when it had occurred, detachment from the tube wall speedily followed. Usually in such cases the ovum is thrown into the lumen of the tube, where it undergoes degeneration before it is aborted into the abdominal cavity. At the same time, there is every indication that a specimen may be completely destroyed and absorbed in case it fails to be aborted. The other possibility regarding the fate of the ovum is that it may eat through the tube wall quickly and by this direct path enter the abdominal cavity. This is usually the case when the ovum becomes lodged at the uterine end of the tube. When implantation is opposite the attachment of the broad ligament, the ovum may perforate the tube on the broad ligament side and then burrow for itself a large cavity. This is usually the fate of an ovum in which the embryo undergoes normal development.

In most of the specimens in which the ovum becomes detached and enters the tube lumen, or possibly may never have been well implanted, we hardly expect a normal development of the embryo. It is this group which I wish to consider first. We have one very good specimen (No. 754) belonging to this group. It came with a history that rupture had occurred, but careful examination did not show the point of the rupture. The patient had given birth to a normal child 5 years before, and was operated upon for tubal pregnancy a week after the beginning of the last menstrual period. Clinically, there was no indication of disease at the time of the operation.

Microscopic sections show that the tube wall is infiltrated with round cells, but is otherwise normal. The ovum, which measures 1 by 2 mm., was lying free upon the folds of the fimbriæ without entering the adjacent blood clot. For the

most part the walls of the chorion have degenerated, showing all stages of necrosis. It appears as though the nutrition of the ovum had been cut off. At no point is it directly attached to the wall of the tube, though the villi are intermingled with its folds, as shown in plate 9, figure 3. The villi are also undergoing fibrous degeneration and the coelom is filled with a mottled magma, into which there radiate strands of mesenchyme cells from the chorionic membrane, as shown in plate 3, figure 2.

It is necessary at this point to discuss briefly the nature of the magma as well as the various kinds of degeneration that the villi may undergo. The nature of the magma has been a puzzle to embryologists ever since it was first described by Valpeau. In the course of time it was shown that magma is present in all normal ova, and according to Retzius it first fills the entire exocoelom. As the amnion distends the magma is swept along ahead of it and ultimately comes to lie as a delicate layer between the amnion and the chorion. This observation has been confirmed many times in the study of the normal human ova and the magma has been described by Keibel in the ova of ape embryos. Giacomini first pointed out that an increase of magma indicates that the ovum is pathological and that it does not contain a normal embryo. In fact, whenever we have an embryo which is obscured by an excessive amount of magma, we are sure that no normal embryo will be found. In my various papers on pathological embryos I have emphasized this point and have also called attention to two kinds of magma, a fresh reticular and an older granular variety. It appears that as the magma increases in quantity a granular mass is deposited between the fibrillæ.

I have also called attention to the fact that the amnion, especially when it is greatly distended, often contains a granular mass, but in general this substance is gelatinous when the specimen has been fixed in formalin. I was formerly inclined to believe that when this became inspissated we then had granular magma in its purest state and that reticular magma belonged to the coelom and granular magma to the amniotic cavity. Further investigation, however, seems to demonstrate that both kinds of magma belong to the coelom, and the substance so frequently found within the amnion is not to be confused with them. At any rate, it seems better at present to speak of this as a third kind of magma, possibly as amniotic magma or gelatinous magma. Until we have further information upon this point it may be better to ignore the amniotic magma. A careful study of very young ova, like those of Bryce and Teacher and of Peters, shows that the entire coelom is at first filled with dense reticular fibrils, with which are intermingled some mesoderm cells. This is especially well brought out by Grosser in his study of Peters's specimen. He is inclined to believe that two small spaces form within the magma on either side of the embryo. These spaces form the primitive exocoelom. The magma fibrils encircle these and radiate to blend with the chorionic wall. An interpretation of this specimen is shown in Grosser's figure 97 in the Handbook of Embryology. It is quite proper to conclude from this figure, as well as from Peters's own figure, that the magma is only a portion of the chorionic wall detached to fill the coelom of the older embryologists—in fact, this is Grosser's view. Stating it somewhat differently, we might say that as the ovum is expanding to pass from the Bryce and Teacher

stage to the Peters stage, its center becomes filled with more fluid and separates the fibrillar connective tissue, leaving them as magma fibrils, so that we must look upon the coelom of the older embryologists, identical in structure with the center of the villi, as the true coelom, which this substance with its cells is pushing aside, as described by Retzius. In pathological specimens, however, the true coelom does not develop normally, but the magma simply becomes thickened, making it appear as though the coelom were filled with the magma. This conception of the magma allows one to interpret properly a section of the chorion and the coelom as shown in my figure 169 in the Handbook of Embryology. It is quite clear, upon second consideration, that the magma fibrils are simply prolongations of the mesoderm cells of the chorion. We can see in this arrangement a repetition of the ordinary development of the connective tissue fibrils, as illustrated by a section through any part of the embryo. In fact, this is well brought out in the human chorion, if it is well stained by the Van Gieson method. I have taken the trouble to make a careful examination, by this method, of a chorion containing a normal embryo and one containing a pathological embryo.

Specimen No. 808 contained a practically normal embryo with a dense reticular magma filling one portion of its cavity. Sections were stained with the Van Gieson stain and drawn in black, as given in plate 11, figure 3. At the point from which the illustration is taken the chorionic wall is not very compact. It is composed of loose fibrils intermingled with cells. The fibrils, which are stained intensely red, radiate from the cells, forming a dense connective-tissue framework, as may be seen in sections of the umbilical cord or villi. Just surrounding the cells, or rather the nuclei, the fibrils are more marked, having a tendency to grow in parallel lines; in other words, they are more highly developed, and as the chorion becomes older we find that all the fibrils of the chorionic wall undergo similar changes. As long as the magma fibrils fill the cavity of the ovum a condition is maintained like that shown in the figure, but as the amnion pushes the magma fibrils up against the chorion, they form a layer which blends with it. This is the ordinary development of this process.

When the cavity of a pathological ovum is filled with a dense magma, or, as it is usually put, when the coelom is filled with a dense reticular magma, it also becomes fibrillar, and this is well shown in No. 402, which is a typical pathological specimen. Here the fibrils radiate from the chorionic wall and are also sharp and wavy, having a tendency to run parallel with one another. We have here a thickening of the magma in its normal position, without a development of the amnion. There is an excessive growth of the magma fibrils, which in this specimen radiate from the chorionic wall to the center of the ovum. As specimens like this continue to grow, the delicate connective tissue fibrils of the magma become intermingled with flakes of a peculiar tissue which take on an intense stain in hæmatoxylin. Sometimes a few of these flakes are found in specimens containing normal embryos, but in numerous pathological specimens large areas of these flakes are seen. In tubal pregnancy they are often present, and at first were described as large plaques of mucin, "possibly representing a degenerate yolk sac," but upon further study it was soon found

that these plaques first arise within the magma fibrils of the ovum quite independently of the yolk sac. They grow in large masses, and with the destruction of the ovum they are also spilled out into the tube lumen. The plaques are stratified, forming layers that alternately take on the hæmatoxylin more intensely. When cut transversely they resemble sections from an onion with a central nucleus, as shown in plate 11, figure 4. The central point is generally intensely stained. When a section is not cut transversely, the markings are more or less parallel, as shown in the other portion of this same figure. Gradually, in the later development, these plaques run together and form a spongy substance which stains intensely with hæmatoxylin; the individual portions of the plaques, however, always show stratification. Whether the last word has been said about granular magma it is difficult to determine at present. It may be that only a portion of granular magma takes on this stain, while the other portion does not. At any rate, it is established that the reticular magma is formed of connective tissue fibrils which belong to the cells of the chorionic wall. They are not elastic nor white fibrils, but practically identical with the connective-tissue syncytium of the embryo and the chorion. The granular magma is a peculiar substance composed of individual particles that are stratified and stain intensely with hæmatoxylin.

#### DEGENERATION OF VILLI AND CHORION.

We have repeatedly alluded to the various kinds of degeneration of villi and their covering. It remains now to consider this question in a somewhat connected way, as it is perfectly well known that villi are constantly undergoing degeneration in normal development. The trophoblast becomes active in regions where it receives nutrition, but when this nutrition is cut off it degenerates. In general, the stroma of the villi responds in a similar way. After the trophoblast has become necrotic, the body of the villus degenerates. When the trophoblast is active the villi sprout and grow. We have a condition which is frequently seen in organic nature and is well illustrated by the growth of the vine over the lattice-work; the favored twigs grow and the rest fail.

*Trophoblast.*—When the larger villi are detached from the decidua in normal development, they contract and form small nodules composed mostly of trophoblast cells. These soon become white and necrotic, and can readily be observed with the naked eye, as they measure about 1 mm. in diameter. In the course of time these necrotic masses are invaded by new trophoblast cells, usually from neighboring villi, and we have here an interesting phenomenon, the dead cells being eaten up by the living. This may be seen in the normally developed ovum. A modification of this process is observed at the point of juncture of the villi with the decidua. Here also the necrotic masses, often spoken of as fibrinoid substance, are invaded by new trophoblast cells, giving in transverse section the appearance of cartilage. Fibrinoid substance is probably derived from a variety of sources, trophoblast, epithelial cells, blood, and also fibrin. This is well shown in plate 2, figure 3, which is from an ovum containing a normal embryo. The figure pictures the tips of the



villi reaching through a blood clot, the normal trophoblast surmounting the villus and clot, and at the border the cells are undergoing hyaline degeneration, which grades over into strands forming the fibrinoid substance. In the course of time the degenerate cells coalesce to form either a stratified mass or irregular plaques. This is all shown in the figure. The larger plaques are now often invaded by fresh trophoblast cells, and so the process continues. Such a condition is found just as frequently in tubal as in uterine pregnancy. Another type of degeneration of the trophoblast is well shown in specimens which have become suddenly detached from the tube wall. Here large masses of cells become necrotic suddenly, and this condition I have usually spoken of in my notes as an indication of strangulation of the ovum. Such a specimen is well illustrated in plate 2, figure 4. Here we have a villus, the core of which is almost entirely destroyed, surmounted by an irregular layer of trophoblast from which the nuclei have largely vanished. From this degenerate covering fibrils run out in all directions, becoming continuous with the adjacent fibrinoid substance. In this specimen there has been a secondary invasion of the dead villus by maternal leucocytes which are polymorphonuclear and also show fragmentation. A more intense reaction in the sudden death of the trophoblast is seen in plate 2, figure 6. Here also there is no inflammatory reaction, so that the process of histolysis is not complicated by it, but the protoplasm of the trophoblast, forming an irregular hyaline mass, also continues to surround the fibrinoid substance. In this specimen the arrangement of the nuclear granulars is especially interesting; they have run together, forming large masses, which stain intensely in hæmatoxylin. In some portions of the specimen these masses may be so large as to be seen with the naked eye. In general the mass of nuclear substance grades off into fine particles, as shown in plate 2, figure 3. Sometimes these particles are arranged in streaks or they are scattered irregularly and may then be spoken of as nuclear dust. This is often seen in specimens which have become detached suddenly from the tube wall. A similar condition, but not so intense, is shown in plate 4, figure 1. In this we have all stages of destruction of the stroma of the villus. On account of its peculiar appearance, as well as on account of the fact that it often takes up the hæmatoxylin stain, I have termed this kind of degeneration "mucoid." At any rate, whether it be mucoid or not, the core of the villus gradually breaks down and disintegrates. While this process is taking place, we often see scattered through the stroma of the villus large protoplasmic cells, first observed by Hofbauer (plate 2, fig. 7). These cells, which I have repeatedly seen in the villi of pathological ova, may be a type of wandering cells; at any rate, when the villus is being invaded by the leucocytes and trophoblast, it might be thought that they arise from the latter, but this is improbable. Plate 2, figure 4, and plate 11, figure 2, are taken from the same specimen and represent two stages of "mucoid" degeneration. In both stages the villi are being attacked by the leucocytes. In plate 7, figure 2, there is a large area of blood around the villus which contains no strands of fibrin or fibrinoid substance. The leucocytes are scattered throughout this area as well as the adjacent area containing the fibrils. This picture is seen very frequently in sections from tubal pregnancies. Immediately around the villi there is no fibrin whenever

the section is mottled, that is, when it contains both old and fresh blood; the latter nearly always encircles the villi. This would indicate that when the ovum is lodged in a clot fresh blood can reach the chorion only along the line of its villi. As this small layer encircling the villi contains no fibrin and as the small mass of blood which enters the intervillous spaces has not coagulated, it seems allowable to conclude that the trophoblast produces a ferment which prevents coagulation of blood. In fact, this idea seems to be acceptable to all authors who have written upon this subject. So when we have relatively large ova covered with tufts of villi, the fresh blood produces large patches around them, while the older blood, somewhat distant, is forming the well-organized clot. This condition is shown in plate 8, figure 4; plate 9, figure 3; and plate 10, figure 1. It can also be demonstrated in practically any distended tube containing a pathological embryo. On a smaller scale the condition is well shown in plate 7, figure 2.

Nevertheless, we frequently find large independent clots in a normal implantation, both within the tube and uterus, showing that the anti-clotting property of the trophoblast does not extend far beyond its own border. It prevents clotting of the blood in its immediate neighborhood. When the trophoblast taps the blood vessels the escaping blood does not coagulate until it has formed a larger mass within the intervillous spaces, but it then forms a large rigid clot.

The most unusual kind of degeneration of villi is fibrous. We recognize in this variety an advanced stage of development; that is, a fibrous degeneration of a young villus makes the stroma appear like that of an older one. Undoubtedly this process may take place very rapidly. This statement is adduced from a condition found in specimen No. 874. Here the ovum was divided, part of it lying near the point of implantation in the uterine end of the tube and the other part somewhat distant in the fimbriated end. In the second portion practically all of the villi have undergone marked fibrous degeneration. Three stages of this process are shown in plate 2, figures 1 and 2, and plate 3, figure 1. The main wall of the chorion of the specimen No. 694 appears to be quite normal. The mesenchyme is delicate and transparent, with active strands reaching into the cavity of the ovum; but the chorion is well encircled by a clot, which in turn is perforated by a number of villi containing an active trophoblast upon their tips. Many of the villi have undergone mucoid degeneration and there is much nuclear dust. A few, however, are undergoing fibrous degeneration, as illustrated by this figure, which shows a villus lying free within the fresh clot. It is also surrounded with numerous leucocytes not shown in the picture. Plate 2, figure 2, is taken from a specimen in which only a few villi are found within the tube lumen. Most of them are more fibrous than the one from which the figure was drawn. Here the stroma is denser than in the previous specimen, and there is no regular trophoblast lying upon the villus. At one point it forms a necrotic fibrinoid mass. It is interesting to note that where a villus comes in contact with the tube wall it also is undergoing a hyaline degeneration. The extent of this process is shown in the coloring in the figure.

Plate 3, figure 1, shows a most advanced stage of fibrous degeneration. The ovum has reduced itself to a single fibrous strand and the coelom is obliterated.

From this strand, which is a collapsed ovum, delicate fibrous strands reach to the surface of the clot. One of these is shown in the figure. It can be seen that the epithelial covering is separated from the body of the villus. The space between the villus and its covering is filled with a coagulated fluid which takes on the eosin stain. In different portions of the specimen this fluid contains numerous red blood corpuscles, indicating that the surrounding villus is composed of red coagulated plasma. As the epithelial covering lies free in this fluid and was undoubtedly fixed when the specimen was preserved, we must view this relation as being normal for this stage of degeneration. According to the history of this specimen this ovum was 46 days old, while a normal specimen of this size would not be more than half as old. This shows the probable duration of degeneration in the specimen. The clot itself is highly organized and permeated with stratified fibrils, which form a very dense network on the outside of the specimen. There is no hemorrhage in it and not much infiltration of leucocytes. We have here an example of a tubal pregnancy with almost complete destruction of the ovum through fibrous degeneration.

*Specimen No. 754.*—Now that I have given a somewhat detailed account of the magma and the various kinds of degeneration of villi, I can take up the description of small pathological ova without repeating too often the description of the various kinds of degeneration found in them. This specimen seems to have been dead some time before the operation, as most of the trophoblast is necrotic and there is also a great deal of nuclear dust. Outside of the chorion there has been quite an extensive invasion of leucocytes. There are a few small masses of syncytium, which still appear to be alive, but some of them are vacuolated. The magma is mottled and at its periphery some delicate fibrils are seen. Otherwise, each of the two types of granular magma is quite homogeneous in structure. Occasionally they are mixed, that is, the particles of darker magma invade the lighter, and *vice versa*. All this is shown in plate 3, figure 2. The relation of the chorion to the tube wall is shown in the outline of plate 9, figure 3. Most of the chorion and its villi are lodged between the blood clot and the folds of the tube wall, but nowhere is the chorion attached to the surrounding structure through the trophoblast. The conclusion is that the ovum was attached high in the tube; it is now being aborted into the peritoneal cavity.

*Specimen No. 488.*—This specimen, which was discussed at some length when speaking of the etiology of tubal pregnancy, is also of especial value at this time, as it shows the structure of a small ovum in process of abortion. The ovum had attached to it numerous small, slender villi, which are outlined in text-figure 9. These were embedded in a fresh blood-clot, as is indicated in text-figure 8. On account of the great interest of this specimen, we also give a drawing of the tube with part of it cut open (text-figure 7). The tissues of the ovum are pale and do not stain very well. The villi are partly necrotic, partly granular, and partly fibrous. The trophoblast is scanty. The coelom is filled with granular magma, through which radiate some mesoderm cells and in which is lodged a crumpled membrane, as shown in plate 5, figure 4. This mass has also scattered through it a good deal of maternal blood. No doubt some of this blood was dragged in as a result of the manipulations which were required to free the specimen from the tube

wall, but since so many cells are embedded within the mass of magma, it can not be admitted that all of them were introduced by mechanical processes. It may be that the crumpled membrane represents the amnion, but this could not be established with certainty, although the specimen was cut into serial sections. We have in this specimen a repetition of the condition found in No. 754.

*Specimen No. 367.*—In this, the third specimen in this group, the process of degeneration is not so far advanced as in the other two. The coelom is filled with reticular magma, as shown in the figure. The villi are fairly well developed and there is some trophoblast, most of which is necrotic. This specimen has entirely separated itself from the tube wall and lies free within the lumen. It was removed from the tube wall by Mr. Brödel, who made a sketch of the clot and the ovum. He peeled the ovum out of the clot and found on one side a small tuft of villi. This was cut into serial sections. Some of the villi are undergoing mucoid degeneration, and one of these is shown in text-figure 5, and plate 4, figure 2.

Another specimen which belongs to this group is No. 520. It was found on the side of a tubal clot which measured 35 mm. in diameter. The ovum itself is 5 mm. in diameter and is filled with a reticular mass. Most of the chorionic wall is necrotic, but there are a few slender fibrous villi, one of which penetrates the clot to its middle. There are loose villi within this clot. This specimen has become entirely separated from the tube wall and is surrounded by a large highly organized clot, indicating that the tubal pregnancy is of considerable duration. In many respects the fibrin within the clot corresponds with that of the next specimen.

*Specimen No. 570.*—In this the most advanced stage of degeneration is shown. It is possible that when degeneration began this specimen was somewhat older than the ones just described. The ovum has been reduced to a single mass of fibrous tissue without a coelom, and from this central mass several long, slender villi arise, which reach to the periphery of the highly organized clot containing the ovum. The tip of one of these villi is shown in plate 3, figure 1. The trophoblast is entirely degenerated, and the clot is composed of a dense network of fibrils which stain intensely with hæmatoxylin. Here we have a detached ovum which has undergone complete fibrous degeneration within a highly organized clot.

There are a number of other small specimens which belong to this group, and which, therefore, can be treated collectively. In No. 154 considerable activity is apparent. The villi are somewhat fibrous, and have upon them a considerable amount of trophoblast, which at points is quite active, especially where it comes in contact with the blood. No. 367 was found free in the abdominal cavity. The ovum is 10 mm. in diameter and is well developed. The villi appear normal. The coelom was filled with a dense reticular magma, but no embryo could be found. Specimen No. 378 has an appearance somewhat similar to that of No. 754. It is dumbbell-shaped, and is 12 mm. in length. This specimen had partly eroded the tube wall, and one end of the dumbbell was projecting into the peritoneal cavity, while the other extended back to the middle of the clot. The coelom contained a considerable amount of granular magma. The syncytium was necrotic, showing that the ovum was partly strangulated. The other portion of the syncytium

seemed quite normal, a number of tufts being vacuolated. No embryo was found in this specimen.

It having been shown that the ovum must gradually disintegrate and be absorbed, we have looked with special care to find remnants of specimens after the small ovum has fallen to pieces. A good specimen of this kind is No. 472. There is little to be said about it, as only a few villi were found scattered within the tube lumen. A larger group of villi, shown in plate 2, figure 2, was found in the lumen near the fimbriated end, lying within a cleft which no doubt had held them there for some time. The degree of fibrous degeneration and reaction of the villus with its trophoblast upon the tissue of the tube wall have already been described. In other parts of the section are other smaller groups of villi which have undergone a greater degree of degeneration. Some of the trophoblast is found well embedded within the smaller clefts of the tube wall, and, wherever it is present, we find signs of a reaction upon the tissue of the tube wall. In the immediate vicinity of the villi there is fibrinoid degeneration, surrounded by extensive leucocytic infiltration.

The specimen which fits in with No. 472 is No. 787. It is much like it except that the few scattered villi are encircled with a great deal of fresh blood. The specimen consists of four blood-clots, which with the distended right tube, measure 11 mm. in diameter, the distention being near the fimbriated end. The blood clots were produced by blood which had leaked into the peritoneal cavity. The tube was examined with great care and it was found that its uterine end and folds were matted together, almost obliterating its lumen. There are also numerous out-pocketings of the epithelial lining. In the middle of the tube the adherent folds form a plexiform mass, encircling the organized clot. There are also numerous fresh hemorrhages. At one point a small group of fibrous villi was found lodged between the clot and the mucosa, which in this region was infiltrated with fresh blood. This shows clearly that the hemorrhage in these cases arises from the tube opposite a small mass of fibrous villi. No doubt in the course of time this bleeding would flush away the loose villi and thus bring these cases of tubal pregnancy to a happy conclusion.

Another specimen in which there is a large blood clot and few villi is shown in the sections from No. 514. The blood clot here appears to be quite fresh and scattered through it are a few fibrous villi. At points surrounding the villi are small tufts of vacuolated syncytium, showing that there is some activity left when the trophoblast comes in contact with fresh blood. It appears as if the few villi have been engulfed by a fresh mass of blood, which will ultimately be discharged into the peritoneal cavity, carrying these villi with it. A different fate is shown in specimen No. 539. This shows a highly organized clot full of fibrin, which is especially marked at its periphery. The clot is also markedly infiltrated with leucocytes at its periphery. It peels out easily, measuring 1 cm. in length and 5 mm. in diameter. After it had been cut into serial sections, a few degenerate villi were found scattered through the middle of the clot. Some of these had undergone mucoid changes and others were fibrous. Many of the villi were filled with polymorphonuclear leucocytes, which were very numerous throughout the clot. In the

course of time this clot might have been extruded into the peritoneal cavity, or it might have undergone further organization, ending ultimately in absorption. It is difficult to find fewer villi than have just been described in these specimens, except when they are held together with a large clot. It is simply a matter of chance that only a single villus is found attached to the tube, but quite frequently only a few villi appear in the larger clots. Good specimens of this sort are No. 298 and No. 659, in which 3 or 4 villi were found. They were small, irregular bodies, giving no evidence that they had been detached from the chorion—that is, they were rounded off on all sides. The same is the case in specimen No. 519. At this point a specimen which is especially interesting is No. 794, in which the tube was well distended and the clot was not adherent to the tube wall at any place. After repeated examinations no villi could be found with certainty. At a few points small groups of necrotic cells were seen, which may represent the last remnants of degenerated villi; yet it remains a matter of opinion whether or not this tube contains any villi, though it can be considered as a specimen from which the villi have nearly or entirely disappeared (plate 5, fig. 3, and plate 6, fig. 7).

In all the specimens just described, excepting No. 378, the ova are not attached to the tube wall. In all cases they seem to have gained nutrition directly from the epithelial surface of the tube, or from hemorrhages, or from blood which comes from the folds to which the ova begin to attach themselves. They were speedily separated and moved around free within the tube lumen. Ultimately they were engulfed in a fibrous clot or were aborted into the abdominal cavity. No. 378 represents the transition stage; here the ovum had become well attached to the tube and was then promptly torn loose. In order to make this point clear a third set of specimens will be described.

*Specimen No. 540* shows the coelom well filled with magma and its chorionic wall partly fibrous and partly necrotic. Some slender villi arise from this wall and reach through the blood clot to the folds of the tube, which shows a very pronounced follicular salpingitis. At one point several villi are entering one of these follicles and coming in contact with fresh blood. On these villi the trophoblast is active, so this specimen may be looked upon as being still attached to a fold of the tube, but in which, on account of the extensive hemorrhage, the ovum has collapsed and been strangled (plate 6, fig. 6).

*Specimen No. 673* shows the process less advanced than in No. 540. Here the chorionic wall is sharply defined, the coelom contains maternal blood, and the villi are very irregular, but some of them reach to the tube wall, where they are fairly well attached and show an active trophoblast. At one point the trophoblast is puncturing a blood vessel. On one side of the hemorrhage there is a crescent-shaped space which represents the tube lumen. In this case the implantation has been interstitial and abortion has taken place into the tube lumen. At any rate, the ovum has been partly attached to the tube wall and is at the beginning of strangulation.

*Specimen No. 772* is the last specimen of this group. The clot lies free within the tube lumen; the chorion is collapsed and fibrous, and some of the villi are still

reaching to the periphery of the clot, where they come in contact with fresh blood. Here the trophoblast is active, but there is no ovum to nourish. It appears as if the independent villi possess a considerable power to grow even after they are separated from the ovum. Several specimens, to be described presently, will bring out this point.

I have separated the last 3 specimens from the rest for the reason that in these cases it is practically impossible to eliminate implantation within the tube wall. In the small specimens it seems quite clear that at most the ovum attaches itself only to the folds of the tube and never becomes well implanted within the muscular wall. As soon as hemorrhage starts up it is naturally detached and encircled by the clot, but in the last 3 specimens it is not clear whether the ovum had only attached itself to the tube wall or had actually become implanted within it. This point can not be determined definitely by the technical methods I have employed. Serial sections are here required. For the present this question remains open.

*Other specimens.*—In cases in which the ovum remains attached to the side of the tube wall for some time, it is quite clear that the method of its degeneration would differ from that which occurs when the ovum is entirely detached and free in the tube lumen. It certainly seems probable that the ovum receives its nutrition best in case it comes in contact both with the tube wall and with fresh blood. It appears as though both these elements are required to produce the most perfect pabulum, so that the ovum free in the tube lumen must feed upon maternal blood, while that still attached to its wall receives its nutrition also from the maternal tissues.

An interesting specimen in this connection is No. 415. It came from an operation which took place 6 weeks after the last menstrual period. The tube was hardened *in toto*, and then cut into blocks and the region in which the villi were seen was cut in serial sections. In these was found a small clump of villi attached to the folds in the tube and undergoing mucoid degeneration. At one point there was a single villus within the tissues of the fold encircled by an extensive trophoblast which radiated in all directions. Here, then, we have a small mass of necrotic villi and a single one which is active.

A more advanced stage is shown in No. 773. A single fold of the tube has the ovum implanted within it. This fold is distended and looks much like a cherry about 8 mm. in diameter, hanging into the tube lumen, which is about 18 mm. in diameter. Within the center of this nodule are a few villi covered with a certain amount of trophoblast and encircled by fresh blood. From this central mass the blood forms layers which are more successfully organized as the wall of the fold is reached. The principal mass of blood within the tube lumen is of uniform consistency, but contains no remnants of the ovum. It appears that this ovum had attached itself within the tissue of the folds and there gradually undergone degeneration. A similar condition is seen in specimen No. 772. In this trophoblast and villi are more active and some necrotic villi are scattered through the blood clot within the lumen of the tube.

A far more active picture is supplied by No. 720. Here the trophoblast is attached around for nearly two-thirds of the circumference of the tube. In all

probability this was a case of interstitial implantation with the crescent-shaped lumen of the tube on one side. In many respects the attachment to the tube wall and active trophoblast is much like that seen in No. 808, which contained an almost normal embryo. The villi are partly normal in appearance and partly edematous. The trophoblast over the villi is very active, especially where these come in contact with the tube wall. At these points they might pass for normal villi and trophoblast.

About 6 specimens remain, which show the fate of an attached ovum extending into the organized clot within the tube lumen. In all of these specimens the lumen encircles more than one-half of the clot, so that it is impossible to determine, with any degree of certainty, whether we are here dealing with a true interstitial implantation or whether the ovum was attached only to a fold in the tube wall, as is well illustrated in specimens Nos. 415, 473, and 418. The first specimen of this group (No. 659) contains a well-formed clot, having in the center a few small fibrous villi. Some of these, in turn, are encircled with a narrow zone of fresh blood. Another specimen belonging to this group (No. 575) contains a coelom 5 mm. in diameter; that is, the ovum did not collapse. Between the coelom and the tube wall is a mass of radiating fibrinoid tissue with scattered villi covered with necrotic trophoblast containing much nuclear dust. Some of the villi are also necrotic, some are undergoing mucoid degeneration, and others are fibrous. A few of them are encircled with a zone of fresh blood. Curiously enough, these are undergoing mucoid degeneration. No. 726 gives an appearance similar to that in No. 659, excepting that the distention of the tube is greater. Here the description of No. 575 could also be applied to this specimen. There are a few fibrous villi and a few which have undergone mucoid degeneration. These latter are also encircled by a zone of fresh blood.

Nos. 762 and 809 can be taken up together, as in many respects they are alike. In both the tube wall contains an extensive hemorrhage, which has not become organized to any great degree. Both contain scattered fibrous villi, a ramified system of fibrinoid substance, and a great marked invasion of leucocytes. These pass along the line of the fibrinoid substance. At some points the villi are being destroyed by the leucocytes.

The group of specimens in which the ovum has become fairly well implanted in a fold of tube wall differs in several respects from a group in which the ovum lies free within the tube lumen. In the former the ovum grows to a larger size before it begins to degenerate, there is a more marked hemorrhage, and the degeneration of the ovum is delayed; in other words, there is a greater mass of necrotic tissue to undergo destruction.

The remaining group to be considered consists of ova which have become well implanted in the tube wall and contain practically no remnants of the embryo. Such a specimen usually contains a well-defined coelom, and occasionally a very small remnant of an embryo may be detected. It is probable that the embryo was present in more of the cases, but was overlooked. This group is to be viewed as a continuation of the one containing pathological embryos. In the further course of destruction the embryos gradually disintegrate and finally the chorion is left



attached to the tube wall. In the first specimen of this group (No. 825) the chorion appears to be normal and the coelom well defined. This specimen is described in the protocols and is accompanied with two good illustrations. Plate 9, figure 5, shows a section through the middle of the most distended portion of the tube. One can see, at once, that the ovum contains two cavities, and further examination shows definitely that we have a double ovum; but in neither was there an amnion, and only one showed any trace of an embryo. This consisted of a very small, delicate nodule representing probably the last remnant of the attachment of the embryo to the chorion. This specimen might be classed with those containing pathological embryos, but since the embryo has been practically destroyed, it is of special value when placed at the head of the present group. The villi of the chorion are very active and their trophoblast is firmly attached to the tube wall. The implantation seems to be normal; but for some unknown reason the embryo has been destroyed.

Another specimen which naturally follows this is No. 874. Here we have also a double ovum, one part of which lies within the uterine end of the tube and the other is somewhat distant and in process of abortion. Between the two divisions of the ovum the tube is constricted and contains no chorion within its lumen. Near the uterine end the chorion is well implanted within the tube wall. The lumen of the tube is on one side of the specimen, but the chorionic mass has broken into it. Beyond this the tube lumen is filled with a very much disintegrated ovum, the trophoblast of which, however, shows marked activity. The villi are matted together with fresh blood and the trophoblast is extremely active. At only one point is there a remnant of the embryo, which is being invaded by leucocytes and is undergoing histolysis. In many respects the picture suggests a tissue culture. At any rate, this specimen shows that if the fresh ovum is crushed and intermingled with fresh blood, it may undergo a further growth. The portion of the ovum, which is in process of abortion, has undergone some fibrous degeneration, but the trophoblast is still very active. This portion of the specimen is markedly infiltrated with leucocytes, which have also invaded some of the fibrous and necrotic villi. This specimen differs greatly from No. 835, which seems to show simply a double ovum.

In No. 874 the ovum is double, owing to some injury, whereby the normally implanted ovum has been crushed, partly destroyed, and pushed into the lumen of the tube, and a portion of it is being discharged into the abdominal cavity. There is no history to account for this condition, but examination of the section certainly suggests that the distribution of this crushed specimen was due to some mechanical injury. Another point worthy of notice is that the ovum which is being aborted contains a remnant of a chorion in a somewhat advanced stage of degeneration, whereas the portion near the point of implantation seems to be quite normal. In other words, as this ovum left its point of attachment to move out into the tube, it began to undergo necrosis and fibrous degeneration (plate 11, fig. 1).

There is a small group which follows closely upon the two just described. In these specimens there is a sharply defined cavity which has not collapsed, and some of them contain an amnion. In each the ovum is fairly well implanted within

the tube wall and to all appearances the cavity should contain a normal or certainly a pathological embryo. In general they represent a stage of degeneration in advance of that seen in No. 825. The first specimen belonging to this group is No. 430. The chorionic wall is well infiltrated with blood, the villi are mostly necrotic, and there is a great deal of nuclear dust, which also indicates that a large mass of trophoblast has undergone rapid destruction. Even the chorionic membrane itself is fibrous. No. 495 shows appearances very similar to those just described, except that the degeneration is not so far advanced. There is still some active trophoblast left, but large masses of it are necrotic. At certain points the chorionic wall and villi are being invaded by the syncytium. No. 507 also belongs to this class. In the following two specimens the degeneration seems to be less advanced than in those just described. No. 515 had been examined before it was fixed, and was found to contain a smooth internal surface without amnion. The villi appeared to be fibrous, and some of the trophoblast had undergone hyaline degeneration. No. 517 contained an amnion and possibly the remnants of an embryo. It appeared as though the embryo had been removed through mechanical means. The chorionic wall and the amnion were normal in appearance, but the trophoblast was beginning to undergo complete hyaline degeneration. The specimen suggests that the whole ovum had become detached some time before the operation, since most of the trophoblast and villi are necrotic and large clumps of nuclear dust are present. The specimens that have just been considered show degrees of degeneration in a reverse order. In none was there any marked effort towards further growth, but it appears as if the ovum had become strangulated and had undergone necrosis promptly. There are, however, other specimens (*e. g.*, Nos. 561, 602, and 694) which show an attempt at further growth after the embryo had been destroyed. In all three there is still great activity of the trophoblast, although much of it is necrotic. We have in these specimens, side by side, some villi that are very active and well implanted and others that are necrotic. A pregnancy of this sort may continue for a considerable time and form a large tubal mole. It all depends on how long the mass receives nourishment from the tube wall. If the trophoblast continues to erode the tube wall, new blood sinuses are punctured, and if this blood in turn comes in contact with the ovum, the specimen may continue to grow. In fact, we see every indication of such a growth when the tubal mass is large. The specimen becomes mottled, that is, between the long fibrous strands larger areas of fresh fluid blood appear, which can be seen through the tube wall and become very apparent when sections are made. Hence the further growth of this type of tubal pregnancy can continue along two paths; first, we may have the generally slow growth throughout the chorion, and secondly, when the strangulation is nearly complete, development may continue, owing to the advent of large quantities of new blood. Illustrative of the former type we have several good specimens. In the first (No. 418) the ovum was still attached to the tube wall, although the chorion had undergone almost complete fibrous degeneration. In many respects the arrangement of the chorion to surround the clot is similar to that shown in plate 10, figure 1. A less advanced stage of degeneration is shown in No. 513. The ovum has collapsed and the villi are long

and fibrous. Some are long and slender. The strangulation here is also nearly complete, and the ovum is pretty well inclosed within an organized clot. A stage intermediate to those just described is found in No. 553. The ovum here is also partly collapsed. It is hourglass-shaped, showing that it is in a process of division. The chorion and its few irregular processes have undergone marked fibrous degeneration. In No. 686 the condition is similar, but the ovum is encircled by a larger clot.

We have represented here, on a larger scale, what was found to take place in the case of the small ova found free within the tube lumen. There occurs a rapid destruction of the main wall of the chorion, leaving the villi free; they then become rounded and atrophic as a result of fibrous degeneration. These small remnants then become surrounded by a well-organized fibrous clot. In larger specimens (*e. g.*, No. 418) the main wall itself not only disappears, but also undergoes fibrous degeneration. Such an ovum then becomes encircled by an organized clot. In order to bring out this point more clearly, we have illustrated three stages by means of diagrams, which have been made from the entire section of the tube containing the degenerated ovum. Plate 8, figure 4, is taken from a case in which there was a pus tube on one side of the uterus and a pregnancy in the other tube. The tube had gradually become distended and contained within it a collapsed and fibrous ovum, as indicated in the figure. From this body a few slender villi reach to the wall of the tube. On one side there is a small lumen of the tube, showing undoubtedly that these sections were taken from the beginning of an interstitial implantation. Radiating through the clot from side to side are large fibrous strands, and immediately surrounding the ovum and elsewhere are large masses of fresh blood.

A different type of specimen is shown in plate 10, figure 1. Here there is a large crescent-shaped tube lumen; otherwise the arrangement is somewhat similar to that in plate 8, figure 4. The coelom is entirely obliterated and from the collapsed ovum are radiating numerous slender fibrous villi. In this specimen fresh hemorrhages are neither so numerous nor so pronounced. A combination of these two specimens is shown in plate 9, figure 1. The coelom is very small and filled with a dense reticular magma, and the villi are numerous and radiate in all directions throughout the specimen. The clot is only slightly attached to the tube wall, and is almost entirely encircled by the tube lumen. The hemorrhages have probably occurred successively, as the fresher blood is of two different colors. It has gradually leaked in, no doubt through the point of attachment of the fibrous ovum to the folds of the tube wall. The following specimens are very similar. No. 765 has within it a fibrous chorion with a considerable amount of reticular and granular magma within the coelom. The villi are mostly necrotic, partly fibrous, and radiate through the large clot. About the same condition prevails in No. 815, but the main wall of the chorion is not necrotic and some villi reach to the tube wall. Most of the villi are necrotic, some are fibrous. In No. 809 there is a general destruction of the ovum. The main wall is fibrous and contains within it a stellate cavity. The villi are large and necrotic and there has been a very extensive invasion of leucocytes.

A hemorrhage forms an unusually large clot in No. 777. It lies mostly free within the tube and contains within it some necrotic villi and several detached folds in the tube wall; otherwise the ovum has vanished. A similar condition prevails in No. 835. Here also are a few scattered villi, some of which are long and fibrous and permeate the clot. The trophoblast is scanty, but on one side it shows slight activity; here it comes in contact with the tube wall and there is marked leucocytic infiltration. The next step would be a complete destruction of the scattered villi and the gradual absorption of the blood clot. Possibly such a specimen would result in a pure hemato-salpinx, but my material does not carry me into a discussion of this subject.

### SUMMARY.

#### CAUSE.

A review of those specimens which are accompanied by data bearing upon the cause of tubal pregnancy shows quite definitely that this condition is associated with inflammatory changes, which must have preceded the lodgment of the ovum in the uterine tube. Under normal conditions the tube is lined with a layer of ciliated epithelium, which constantly works in the direction of the uterus and therefore creates in the tube a stream of fluid from the ovaries to the uterus. The fertilized ovum gets caught up by this stream and if the conditions are normal is carried into the uterus. Any change which delays the ovum in its progress will favor tubal pregnancy. It is well known that abnormal diverticula or duplicate tubes may be the cause of tubal pregnancy. Numerous isolated cases have been described in which a blind tube or large diverticulum contained the implanted ovum. In rare cases the blind inner end of the tube left after an operation is subsequently found to contain an ovum which has arisen from the ovary on the opposite side, which contained the corpus luteum, whereas only on the opposite side was there a passage free between the uterus and ovary. However, these anomalies are rare and cannot be viewed as the rule in cases of tubal pregnancy.

Much more commonly associated with tubal pregnancy is a chronic inflammation followed by adhesions and kinking of the tube. This has been repeatedly observed, but it is difficult to associate adhesions on the outside of the tube with the arrest of an ovum within its lumen. A glance at the protocols of our cases brings out this point. Whenever histories are given, it is frequently stated that there were numerous adhesions binding together the pelvic organs. It is also noticed that tubal pregnancy usually takes place in women who have given birth to a child and then have been sterile for a considerable period. This fact is well known to gynecologists, and they are inclined to believe that the occurrence of tubal pregnancy indicates that the inflammatory condition in the tube, which prevents pregnancy for a number of years, is gradually disappearing, so that if tubal pregnancy had not taken place, the chances are that the tube would probably have become healed in a few years, thus permitting the fertilized ovum to reach the uterus. This theory receives strong support from the study of numerous cases of tubal pregnancy. If the ovum within the tube contains a normal embryo there is but little adjacent inflamma-

tion. If it contains a pathological embryo, the changes in the tube wall are usually marked, and when the ovum is well disintegrated the changes are still more pronounced. Read in the other way this would mean that if the inflammatory condition is nearly healed, the ovum implants itself in the tube and grows normally, but if the results of infection are still pronounced, the ovum rapidly disintegrates. Such an inflammatory process is signalized not only by an inflammatory reaction in the tube wall, but also by very pronounced changes within the tube lumen, the most common of these being a condition known as follicular salpingitis (Opitz). The tubal folds hypertrophy, their tips becoming adherent, and, when sections are made, small cavities are seen between the folds; hence the term "follicular." Often this process is so marked that a section of the tube shows the folds as an extensive and delicate reticulum permeating the entire tube lumen. In such cases the individual meshes of the folds have projecting into them numerous fingerlike processes, reminding one very much of a section of the intestine. While this process is at its height, it is clear that an ovum can not pass through the tube and much less can the spermatozoon pass outward to reach the ovum. It is only after this process has abated somewhat that it is possible to have conditions suitable for the production of a tubal pregnancy.

Another type of change differs markedly from follicular salpingitis, but in a way seems to go hand and hand with it. This condition I have constantly spoken of as outpocketing of the epithelial lining. No doubt this is the variety first described by Werth. Here the muscular wall is thick and fibrous and numerous small diverticula reach out into the muscular coat. Sometimes these are markedly distended at their blind ends. In other species they seem to run in parallel lines, indicating that, instead of a single tube, we have numerous small tubes side by side. Either of these conditions would account for the arrest of the ovum. The ovum is taken up by the mucous membrane of the outer end of the tube and, owing to the impairment of the ciliated cells, is delayed in its progress. On account of this delay it grows too large to be carried through the narrow portion of the tube into the uterus. This condition would be aggravated when the tube lumen is greatly reduced at the uterine end, so we can easily postulate two kinds of changes to account for the two kinds of implantation so frequently encountered. When the ovum lodges at the outer end of the tube, we should expect the outer end of the tube to be lined with fairly normal mucous membrane, but if the ovum is delayed in its progress and becomes too large to pass later through the uterine end of the tube, we should expect to find the tube lumen reduced in size in this situation.

A third type of implantation usually takes place in the middle of the tube, and is the most common variety. In this type we most frequently encounter tubal inflammation and follicular salpingitis. It seems as though the ciliated cells can carry the ovum to the middle of the tube, but no further. The ovum then implants itself within the folds of the tube, and, soon becoming too large for the space it started to occupy, through secondary rupture is cast into the tube lumen. This process is always accompanied by considerable hemorrhage with marked distention of the outer end of the tube. In case the ovum is not aborted into the peritoneal

cavity, it becomes larger and larger; it is encircled by a dense fibrous clot and disintegrates. Often the entire tube wall, which is thin and inflamed, has practically disappeared.

I have intentionally not taken up the question of the nature of the inflammation which appears about a tubal pregnancy. It seems, however, that in certain instances this inflammation is due to the tightening up of an old infection that had occurred at the time of a previous labor, although the evidence points more towards venereal disease as a more usual etiological factor. The more frequent incidence of tubal pregnancy in cities than in country districts and the frequent histories of gonorrhea in these cases point strongly towards the latter as the chief cause of tubal pregnancy. I do not believe that the evidence we have now warrants a more definite statement than this, as the subject can not be determined by the histological picture. For the present, therefore, the question must still remain open.

#### NORMAL IMPLANTATION.

In case the ovum becomes well implanted within the middle of the tube and ruptures into the broad ligament, conditions are brought about which favor the development of a normal embryo. Rupture on the free side of the tube would throw the embryo into the peritoneal cavity and therefore would probably terminate its life. The same is true when the implantation takes place near the uterus. Here the tube distends with difficulty. The ovum burrows into its thick wall and usually passes right through into the peritoneal cavity. We have numerous beautiful specimens illustrating this point.

Table 1, given on page 5 of this article, is arranged in three columns, each column being divided into two, marked "Examined" and "Unexamined," respectively. The specimens have been arranged in this way to facilitate the study of them statistically. When embryological specimens were first sent me only normal ones from tubal pregnancies were included, and this accounts for the large number of specimens in the first 500 of this collection containing normal embryos. For statistical purposes, only the columns marked "Unexamined" should be compared. In these cases the specimens were not selected by the surgeons who performed the operations, so that during a period of 17 years, since No. 109 was sent me, I have obtained 13 normal embryos, 20 pathological embryos, and 47 pathological ova, among 80 unexamined tubal pregnancies. Thus it will be seen that of the pregnancies which were not examined before the specimens were sent to this collection, 16 per cent, or nearly one-sixth of the whole number, contained normal embryos. I am rather of the opinion that this is too large a proportion, inasmuch as the small tubes containing a small ovum were generally not sent to us.

It seems highly probable that, when the ovum is normally implanted and contains a normal embryo, it is attached to the tube wall much as the ovum is attached to the uterus normally. It burrows through the mucous membrane and makes for itself a space between it and the muscular wall. This process is accompanied by a marked hemorrhage probably much more pronounced than is usually the case for a uterine implantation. The trophoblast promptly attacks the venous sinuses of

the tube, first growing around them and then into them, but there is no response in the tube similar to that which takes place in the uterus. In the tube practically no decidua is formed, and as it seems that the decidua is an important factor in preventing extensive hemorrhage, it follows that from the beginning the implanted ovum in the tube must be surrounded by an excess of blood. The blood which is in immediate apposition with the trophoblast does not coagulate and is taken up by the syncytium, which is usually very markedly vacuolated and serves as pabulum for the ovum. All stages of the destruction of the blood corpuscles can be seen in suitable specimens. Particles of red cells are found within the cells of the trophoblast, where they still take on their characteristic stain. Soon these particles become so small that they blend with the protoplasm of the syncytium, giving to it the tone of the staining property of the red cells, so we can find all gradations and colors from red cells to the well-stained syncytium without demarking sharply the blood pabulum in its digestion by the trophoblast. If the hemorrhage is excessive the blood forms a clot—that is, the antibody produced by the trophoblast to prevent coagulation of blood acts only in its immediate vicinity and does not penetrate the larger mass of blood. This clot then becomes a foreign body and can not serve further as pabulum for the ovum. As rapidly as the trophoblast punctures the venous sinuses of the tube it throws up a wall, so to speak, which prevents excessive hemorrhage into the intervillous spaces. If the blood dribbles in slowly, it seems to serve best as pabulum for the ovum. Extensive hemorrhages are prevented by the cells of the trophoblast, which soon change into vacuolated syncytium and thus seem to protect the intervillous spaces. The larger meshes in the syncytium take up groups of red corpuscles, which are held until they fragment and are taken up by the protoplasm in the process of digestion.

The trophoblast also has a marked tendency to produce a peculiar necrosis of the maternal tissues with which it comes in contact, producing the so-called fibrinoid substance. Apparently this is formed primarily in the mesodermal tissue of the mother, but the fibrin of the blood, the epithelial cells, and the free trophoblast do not seem to escape in this form of necrosis. With the aid of the fibrinoid substance a strong wall is formed between the tips of the villi and the tissue of the tube. This mass then forms a line of demarcation between the ovum and the tube wall, even if the latter be ruptured. The implantation cavity then is lined with much fibrinoid tissue upon which are scattered cells of the trophoblast. Later these individual cells penetrate the fibrinoid substance, giving it in older specimens the peculiar appearance of cartilage. Tips of the villi penetrate this wall and from them streams of active trophoblast reach out and puncture fresh sinuses. In every respect the condition found in normal implantation in the tube seems to be identical with that found in the uterus, except that there is no formation of decidua. As the decidua may be viewed mainly as an agent to prevent excessive hemorrhage, it can be spared in the tube in case the trophoblast and fibrinoid substance take its place. In fact, in the latter part of pregnancy in the uterus, the decidua does not seem to play any great rôle.

All together 43 normal embryos in this collection were obtained from tubal pregnancies. The youngest specimen contains an embryo 4 mm. long, and the

oldest a fetus 96 mm. long. Table 5 is interesting mainly as regards the time of implantation of tubal pregnancy containing normal embryos. The larger number fall in the sixth week; that is, our surgeons usually make a diagnosis during the sixth week of tubal pregnancy. No doubt many of those represented in the first part of the table would not have continued as normal specimens; for instance, in the one containing the embryo 4 mm. long there already were pathological changes within the spinal cord. Others had ruptured and the embryo was found free within the abdominal cavity. Thus we could not expect many of these to survive through the full period of normal pregnancy. No doubt they would have succumbed in a variety of ways, but what percentage it is impossible to determine. But of all those that do survive only one-fifth remain normal; the rest become pathological or turn into monsters, as shown by Von Winckel's studies.

TABLE 5.—*List of normal embryos, giving size and age.*

Length.	No.	Weeks.	Length.	No.	Weeks.
"Fifth week".....	338c	5	18.....	496	8
4 mm.....	808	..	18.5.....	432	..
6.5.....	706	6	19.....	431	..
8.....	359	..	19.....	456	..
8.....	612	..	19.....	634	..
9.....	352	..	20.....	790	..
9.....	422	..	Ovum 40×30×30..	667	..
9.....	597	..	25.....	657	..
10.....	426	..	28.....	183	9
10.5.....	109	..	Ovum 60×40×30..	640	..
11.....	197	..	35.....	294	..
11.....	535	..	36.....	449	10
11.....	487	..	37.....	867	..
12.5.....	670	7	43.....	497	..
13.....	175	..	52.....	448	..
13.....	503	..	52.....	851	..
13.....	899	..	54.....	458	11
15.....	350	..	57.....	481	12
15.....	728	..	70.....	179	13
15.....	898	..	96.....	484	14
15.5.....	390	..			
16.....	256	..			
17.....	576	..			

It is interesting to note the fate of 13 specimens containing normal embryos which were not examined before they were sent to me. No. 808 was unruptured and contained what appeared to be a normal embryo; nevertheless, upon careful examination, after it had been cut into serial sections, it was found that a small portion of the spinal cord showed marked histolytic changes. These were limited exactly to the part of the cord giving origin to the motor roots, the dorsal part of the cord appearing to be normal throughout. No doubt had we examined all of the embryos which appeared to be normal we should have found slight changes in different parts of the body of some of them.

It is seen by table 6 that only the larger specimens are unruptured, showing that most of those containing younger embryos came to an end through rupture of



the tube. The larger specimens (*e. g.*, Nos. 576, 431, 657, and 484) reached this stage of development because they did not rupture. In these the tube is evenly distended. In other words only 4 pregnancies among 117, or less than 4 per cent, have survived. Only these are suitable for development to full term. We must look to this group for the specimens which become markedly deformed towards the end of pregnancy. According to Von Winckel, four-fifths of the fetuses are markedly deformed. Therefore the probabilities are that of 117 specimens under discussion only one might reach maturity as a normal fetus.

TABLE 6.—*List of 15 normal embryos that came to the laboratory without examination or selection before the specimens were sent.*

No.	Dimensions of tubal mass in mm.	Length of embryos in mm.	Remarks.
808	70×25×25	4	Unruptured. Histolysis of spinal cord.
706	55×15×15	6.5	Ruptured. Menstrual age, 3 weeks.
389	.....	8	Aborted.
612	30×30×30	8	Ruptured.
597	20×10	9	Aborted.
535	60×55×50	11	Unruptured. Tube wall nearly destroyed.
670	35×30×25	12.5	Just ruptured.
728	.....	15	Ruptured. Menstrual age, 9 weeks.
576	30×30×25	17	Unruptured.
431	60×45×35	19	Unruptured.
657	35×20×15	25	Unruptured. Menstrual age, 3 weeks. Tube evenly distended. Embryo possibly atrophic.
183	.....	28	Aborting. Tube evenly distended.
484	110×100×80	96	Unruptured. Tube evenly distended.

#### TUBAL PREGNANCY CONTAINING PATHOLOGICAL EMBRYOS.

Whenever the degree of alteration in the tube wall is pronounced and accompanied with marked infection, the ovum does not implant itself well and consequently the embryo does not develop normally, but becomes atrophic and degenerates. The more severe this process the more pronounced is the reaction upon the ovum; or, in case it begins to develop normally, excessive hemorrhage around the ovum detaches the chorion from the tube and strangulates the embryo within. It dies suddenly and shows no tendency to grow in an irregular fashion. Later it disintegrates.

The pathological changes found in the tube are well described by Werth<sup>1</sup> and appear in most specimens I have studied. First, there are marked outpocketings of the epithelial lining of the tube, with a thickening of the muscular layer. This condition was first described by Werth, and according to the study of my specimens it appears to be chronic, as it is not accompanied with any leucocytic infiltration. Secondly, an acute condition, which is more frequently found, consists of a hypertrophy of the folds of the tube, which subsequently become adherent, thus forming numerous small pockets in the tube. This condition was first well described by Opitz and is known as follicular salpingitis. The mucous membrane is swollen and infiltrated with leucocytes and there is often an extensive exudate. According to

<sup>1</sup>Werth, *Die Extrauterineschwangerschaft*. Von Winckel's Handbuch Geburtshülfe. Bd. 2, Teil 2, Wiesbaden, 1904.

Werth this condition is usually associated with gonorrhea, and there is nothing in the history of my specimens which speaks against this opinion. The inflammatory process is more marked in those cases containing pathological embryos than when they are normal. In practically all these cases the tube lumen is present, sometimes as a large semilunar slit encircling the hemorrhagic ovum and sometimes as a simple tube on one side of it. It generally remains open throughout its course, showing that in them, as well as in those containing normal embryos, the implantation is interstitial. In general the tube lumen is small at the site of the implantation and becomes large on either side as the mass extends within the tube lumen. It is naturally encircled by the folds of the wall, as is well seen, for instance, in the sketch of No. 808. Rough serial sections demonstrate this point satisfactorily.

TABLE 7.—*List of tubal pregnancies containing pathological embryos.*

No.	Dimensions of tubal mass in mm.	Length of embryos in mm.	Form of body.	Character of change in embryos.
825	90×40×25	0.1	Nodule.....	Mesenchyme containing a few epithelial cells.
342	30×20×20	1	Irregular.....	Small remnant of a greatly deformed embryo at the end of a large umbilical cord.
554	50×20×20	1	Nodule.....	
874	80×30×25	1	Fragment.....	Chorion very active.
196	50×30×30	2.5	Greatly deformed....	
396	40×28×20	2	Double vesicle.....	Tissues in active growth.
324	45×45×45	3.5	Rounded.....	Pathological change in chorion.
697	55×30×30	3	Small body.....	Completely dissociated; menstrual age 10 weeks.
881	110×35×33	4		
808	70×25×25	4	Normal.....	Histolysis of ventral side of spinal cord in thoracic region.
477	.....	5	Irregular.....	Markedly dissociated; menstrual age 2 weeks.
567	55×30×25	5	Atrophic.....	Dissociated.
784	75×35×35	5	Dead; tube ruptured.	Dissociated; organs can not be outlined; menstrual age 8 weeks.
838	27×23×29	6	Tube ruptured.....	Thoroughly dissociated; central nervous system can still be outlined; cord fibrous; menstrual age 4 weeks.
729	20×10×10	8	Normal(?); tube ruptured.	
846	85×40×30	8	.....	Completely dissociated.
804	50×40×40	8	Disintegrated.....	Free cells fill a cavity 8 mm. in diameter.
882	60×45×40	..	.....	
766	55×45×40	10	.....	Complete dissociation; menstrual age 6 weeks.
685	70×60×50	12	Tube ruptured.....	Disintegrating; menstrual age 8 weeks.
524	70×60×50	15	Tube ruptured.....	Embryonic mass seems to be composed of the cord.
307	40×40×40	20	.....	Thoroughly dissociated, with secondary changes in cartilages.
478	85×60×45	22.5	Normal.....	Dead for some time (?); menstrual age 20 weeks.
314	.....	24	Head atrophic.....	Tissues macerated, dissociated, and infiltrated.
479	90×70×70	80	Very edematous; tube ruptured.	Tissues edematous, with secondary changes and adhesions; menstrual age 13 weeks.

All of the specimens containing pathological embryos, whether examined or not, before being sent to the laboratory, are arranged in table 7. I have also included specimens Nos. 825 and 874, which were assigned to the column containing pathological ova, as well as No. 808 from the column containing normal embryos.

The specimens are arranged according to their length, and it at once appears that among those containing small embryonic remnants we have nodular and vesicular forms. Then we have a group of larger embryos, which are regular in form but atrophic. The tissues of these are also more or less dissociated. The third group consists of dead embryos which are markedly dissociated, some of which have

fallen entirely into pieces. The change in these specimens indicates that the process was probably of short duration, as it is marked by extremely severe destructive changes. A comparison of the different varieties of ova obtained from the tube with the pathological ova obtained from the uterus is given in table 8.

Of the group of 13 normal specimens spoken of repeatedly, about 8 came to the laboratory ruptured and 1 was in the act of aborting; another was about to rupture (see table 5). Of 25 specimens containing pathological embryos only 6 were ruptured, showing again that ruptured specimens usually contain normal embryos. In other words, a live normal embryo is probably far more dangerous to the mother than a pathological one.

TABLE 8.—*Varieties of ova obtained from tubal pregnancy compared with pathological ova obtained from the uterus.*

Age.	Pathological from uterus.	Pathological from tube.	Normal from tube.
Vesicular forms.....	19	52	
Without embryo or amnion....	29		
Without embryo.....	15		
Second week.....	4		
Third week.....	18	3	0
Fourth week.....	21	7	0
Fifth week.....	13	6	2
Sixth week.....	27	2	11
Seventh week.....	10	3	10
Eighth week.....	2	0	8
Ninth week.....	1	0	3
Tenth week.....	0	0	5
Eleventh week.....	1	0	1
Twelfth week.....	0	0	1
Thirteenth week.....	1	1	1
Fourteenth week.....	1	0	1
Total.....	162	74	43

It is impossible to obtain any satisfactory data regarding the percentage of the different varieties of specimens obtained from tubal pregnancies. This fact has also been pointed out by Werth, who, however, expresses the opinion that only a small minority of tubal pregnancies live beyond the first month. Of those that become well embedded in the tube wall only a small percentage survive for any length of time, and probably much less than 1 per cent come to maturity. The chief difficulty in obtaining good statistics is that too few specimens fall into a single hand for study. Thus, our own specimens are only numerous enough to indicate the probable proportions. It is even impossible to obtain figures regarding the frequency of tubal pregnancy. The number of operations in a given hospital compared with the total number of patients does not give us any index at all of the true percentage. In fact, surgeons express very different opinions regarding the frequency of this affliction in different districts. Some state that it never occurs in colonial countries; others that it is uncommon in rural districts; and others that it is frequently encountered in cities. A parallel here with the probable prevalence of venereal disease is at once apparent. Beyond this we can not go at present.

In order to make comparison between the ova and embryos in tubal pregnancy and those obtained from the uterus, I shall first give a table modified somewhat

from the one published in my article on monsters. That table rests upon all available statistics, most of which were obtained from Von Winckel. In it the pathological ova were put together, but according to my records of pathological specimens obtained from the uterus, there are 100 ova containing pathological embryos to every 63 without embryos. So, breaking up the probable number (7,048 pathological ova to every 100,000 pregnancies) according to this proportion, we have two numbers (4,330 and 2,718) given under this heading in table 9.

TABLE 9.—*Fate of 100,000 uterine pregnancies.*

	Pregnancies.	Births.	Abortion of normal embryos.	Pathological embryos.	Pathological ova.	Monsters at term.
Number.....	100,000	80,752	11,765	4,330	2,718	615
Percentage....	100	80	12	4.3	2.7	.6

For the sake of comparison it is best to reduce all these figures to a percentage. In each 100 uterine pregnancies 4.3 per cent contain pathological embryos and 2.7 per cent contain pathological ova or rather ova, without embryos.

Drawing upon the general table given in the beginning of this article—that is, using only those specimens which came to the laboratory unexamined—we can build up a similar table, but here instead of 100,000 cases to deal with we have only 80. All the tubal pregnancies in the collection could not possibly be used in drawing up this group of statistics, so I arranged the whole material into two groups with three subdivisions in each group. The first, called “examined,” consists of specimens examined by physicians before the specimens were sent to the laboratory. The second group includes specimens not examined by the physician but sent to the laboratory for me to examine; this group is called “unexamined.” It is seen at a

TABLE 10.—*Distribution of tubal pregnancies in first and second halves of about 1,000 embryological specimens collected.*

	First 500 specimens.		Second 500 specimens.		1,000 specimens.	
	Examined.	Unexamined.	Examined.	Unexamined.	Examined.	Unexamined.
Normal embryos.....	21	4	9	9	30	13
Pathological embryos.....	2	7	0	13	2	20
Pathological ova.....	4	8	1	39	5	47
					117	

glance that the specimens numbered less than 500 arrange themselves very differently from those numbered over 500. There are about 1,000 specimens in the collection and table 10 shows the distribution of tubal pregnancy among the first 500 and the second 500 specimens. It is seen that tubal pregnancies in the second 500 fall off markedly in normal embryos and increase greatly in pathological ova.

The unexamined 80 specimens arrange themselves in a table in which the birth column is zero. 16 per cent of the specimens of tubal pregnancy contain normal embryos, 25 per cent pathological embryos, and 59 per cent pathological ova.

It is probable that the 59 per cent of the pathological ova would have disintegrated and disappeared in some way if they had not been removed by the surgeon. It is also probable that most of the specimens containing pathological embryos would also have disappeared. Then comes the question as to the fate of the 16 per cent of normal embryos. A glance at table 5 shows that most of them rupture or abort, but no doubt the few that remain within the tube may continue to the end of gestation, although some of them die and are aborted. In fact, Werth gives a case in which the skeleton of a very small fetus about the size of a bean was found encapsulated within the tube lumen at the end of thirteen years.

I have attempted to express in table 11 the redistribution of this 16 per cent in cases in which the fetus continues to grow to the end of pregnancy, using, as a guide, the proportion of anomalies in tubal pregnancy at term as given by Von Winckel. Of course this would not always be their fate, because most of this group die long before the end of gestation, but if this redistribution is made it is found that of 100 tubal pregnancies 3.3 per cent would have reached birth, the pathological embryos would be raised from 25 per cent to 35.5, and there would be added about 2.2 per cent of monsters. This row of figures can now be compared with the percent-

TABLE 11.—80 specimens of tubal pregnancy which had not been examined before being sent to the laboratory.

	Number.	Percentage.	Fate of the 16 per cent of normal embryos.	Percentage after redistribution of the 16 per cent of normal specimens.
Pregnancies.....	80	100	....	100
Births.....	0	0	3.3	3.3
Normal embryos.....	13	16	....	0
Pathological embryos.....	20	25	10.5	35.5
Pathological ova.....	47	59	....	59
Monsters.....	0	0	2.2	2.2

age of specimens obtained from 100,000 uterine pregnancies. If this is done it is apparent that the pathological action in tubal pregnancy is far more severe than upon the pathological ova obtained from the uterus. In tubal pregnancy the embryo is quickly destroyed, the ovum is easily detached and becomes necrotic, and is absorbed or aborted. A normal embryo eats through the tube wall, and many of them are also aborted. The appearance of a pathological embryo from the tube is much like that of one from the uterus, but the destruction of tissue is more severe. All this points more towards complete strangulation in the tube. The uterus appears to be a more favorable site for pathological embryos which continue to live. This variety is less frequently found in the tube. It is probable that all small monsters and pathological ova that remain in the tube disintegrate.

There is a marked difference between early and late monsters from the tube and those from the uterus. In the former there is a marked gap between these two varieties. In the uterus there is a finer gradation from one to the other. The conclusion of our study of tubal pregnancy regarding this point is that there is a break within the pathological group in the tube; thus we have the early stages in which the changes are very severe, and later stages which show special varieties but which

seem occasionally to include specimens in which pathological changes must have begun very early. It may be that the change in the spinal cord in No. 808 might have continued to the end of gestation to produce a spina bifida. Otherwise the tubal monsters at term must have arisen from specimens which were normal up to the twelfth week. No doubt the normal specimens of the sixth, seventh, and eighth week, as given in table 4, are of the kind that produce the monsters at the end of pregnancy, as described by Von Winckel. In fact, there is every indication that No. 657 might have turned into a monster, as its head appears to be somewhat atrophic.

I have been unable to collect any good data regarding the frequency of monsters in tubal pregnancy, but, according to Joachimsthal, they are very rare, and according to Leopold they are relatively rare, while Martin and Orthmann, Ruge, Olschhausen, and Veit state that they are more common than in uterine pregnancies. It may be that the latter gynecologists confused early pathological embryos with older monsters, while the former did not. The line of demarcation between them is difficult to draw, hence the distinction is not frequently recognized.

Von Winckel has done us a service in collecting those fetuses from tubal pregnancies which continued to live and were removed alive from the abdominal cavity. His fetuses must have arisen from the 16 per cent of normal embryos found by me in unselected unruptured tubes. 84 per cent of the specimens were so markedly pathological and so far destroyed that they could not possibly have lived until the end of pregnancy. Von Winckel's cases are especially valuable for determining the fate of the embryos that must have been normal before the tube ruptured, that is, during the first months of pregnancy. He first gives the cases that have been published by others, as follows:

TABLE 12.

Date.	Author.	Number of specimens.	Number of monsters.
1876	Henning.....	150.....	2 and 6 compressed fetuses.
1894	Orillard.....	6 (alive).....	6
1893	Schelling.....	257.....	25
1891	Küchenmeister....	43.....	7
....	Harris.....	45 (alive).....	11
1901	Sittner.....	126 (alive).....	36
1902	V. Winckel.....	13 (alive).....	13
....	Kehrer.....	93 (uterus bicornis).	7

It will be seen that the percentage of monsters increases from year to year. However, Von Winckel thinks that it is safe to say that one-half of the fetuses in ectopic pregnancy are deformed, the most common deformity being defects of the hands and feet. He further collected 87 cases (14 of his own) and found that in 57 of them the fetuses were much deformed and in 12 were markedly monstrous. Among these there were 6 cases of hydrocephalus and 1 each of hydromeningocele, encephocele, anencephalus, omphalocele, spina bifida, and hyospadia. In addition, the head was found deformed in 57 specimens, the legs in 44, the arms in 35; in 12 there were club-feet, and in 4 cases amniotic bands. The placenta was usually deformed, sometimes multiple, broad and thin, or short and thick, and often very hemorrhagic.

In general, then, it is the poles of the body that suffer most, the head being deformed in 75, the legs in 50, the arms in 40, and the trunk in 4 per cent of the cases. But while it is clear that a good share of the difficulty is due to ordinary mechanical causes, in the 12 cases that were markedly monstrous these could not be the sole factor; for them we must hold the hemorrhagic placenta responsible, a growth that could be included under what I have termed faulty implantation. Therefore, 14 per cent of Von Winckel's 87 tubal cases which were normal in early pregnancy become monstrous, while in uterine pregnancies the percentage is below 1.

#### PATHOLOGICAL OVA.

*Pathological ova without embryos* are very frequently encountered. In our selected cases 59 per cent fall under this heading, while in specimens obtained from the uterus there are only 2.7 per cent. Moreover, as Werth also admits, in both sets the figures are probably much too small, as no doubt many of the earlier specimens are lost or overlooked. We have no good data regarding the number of ova which disintegrate early, but the study of comparative embryology warrants the conclusion that many young ova degenerate and disintegrate. I am informed by Doctor Huber, who has studied with great care much material from rats, that some of the fertilized ova break down before implantation or what amounts to implantation. The same seems to be true regarding the pig. We usually find more corpora lutea in the ovaries than embryos in the uterus, indicating that all of the ova do not produce normal embryos.

Table 13, which includes all of the pathological ova studied, shows that most of them are less than 10 mm. in diameter. Many of them are small because they are collapsed. At one time they were larger, but as a result of excessive hemorrhage they became detached, and the collapsed ovum indicates that it is degenerating. Very few of them are in a process of abortion and none of them have ruptured through the tube wall. The ova are simply being disintegrated. This is indicated by the pathological condition of the magma, which is densely reticular and often very granular. The wall of the chorion is degenerating and the line of demarcation between it and the coelom is often obscure. Strands of cells extend from the chorionic wall into the coelom, and the main wall of the chorion is often ruptured. The villi usually show a variety of degenerative changes of which the most common is fibrous, but often mucoid. The trophoblast is usually scanty or necrotic, with disintegration of the nuclei, forming nuclear dust. When this is liberated, it is scattered through the specimen. The dead villi are soon invaded by the leucocytes and also by adjacent trophoblast which feeds not only upon them but also upon necrotic masses of trophoblast. As the ovum collapses it also begins to break up. The villi are detached and scattered in the blood clot. The isolated villi may continue to grow in case they are capped by active trophoblast, which continues to tap fresh vessels. As the blood clot becomes larger the single villi are separated more and more, ultimately undergoing complete degeneration. In a few instances the whole ovum breaks into pieces. It first becomes hourglass in shape, the two parts then separate, and in one case (No. 874), one part is aborting, whereas the other part is near the uterus, where it is still growing actively. Finally, the villi

practically disappear and the clot becomes smaller and organized. These very small clots which are found in the tube are composed almost exclusively of fibrin containing a few small degenerating villi. At any time during this process the whole tubal mass may be extruded and bring the pregnancy to an abrupt end. In case this does not take place the clot probably disappears entirely by absorption. My material does not warrant any statement regarding the ultimate fate of a small fibrous clot or of an excessive hemorrhage in the tube, which contains within it a few fibrous villi; nevertheless, the suggestion that the latter condition may have some relation to hematosalpinx, hydrosalpinx, and pyosalpinx is pertinent.

TABLE 13.—*Pathological ova.*

No.	Dimensions of tubal mass in mm.	Dimensions of ovum in mm.; menstrual age.	Villi and coelom.
154	.....	10×10×10.....	Fibrous.
298	.....	4×4×4 (3 weeks).....	Fibrous.
361	.....	10×10×10 (7 weeks).....	Dense reticular and granular magma. Tubal abortion.
367	.....	10×7×5 (2 weeks).....	Dense reticular magma.
369	.....	(3 weeks).....	
378	.....	12.....	Granular magma.
415	40×20×20	(6 weeks).....	Villi, almost hydatiform.
418	50×25	7×4 (5 weeks).....	Fibrous (collapsed).
430	60×35×35	25×20×15.....	Scattered necrotic villi.
472	.....	.....	Scattered fibrous villi.
488	.....	5 (6 weeks).....	
495	30×25×25	12.....	Dead membranes.
507	50×35×35	.....	
513	70×30×30	15×10.....	Fibrous.
514	15× 8× 8	.....	Few degenerate villi.
515	.....	15×12.....	Fibrous villi.
517	40×30×30	.....	Granular mass in amnion.
519	.....	.....	Scattered villi.
520	60×35×30	5×3×3.....	Collapsed ovum.
539	40× 8× 8	10×6×6.....	Scattered villi.
540	50×16×16	2.....	Attached to fold.
553	50×23×23	5 (8 weeks).....	Collapsed ovum. Many Hofbauer cells.
561	28×22×22	Collapsed (11 weeks).....	Granular magma.
570	25×14× 8	Collapsed (6 weeks).....	Fibrous villi.
575	40×23×18	5.....	Necrotic and mucoid villi.
602	50×25×25	13 (11 weeks).....	Degenerate villi. Tubal abortion.
659	30×15×10	.....	Few villi.
673	16×16×16	6×3 (11 weeks).....	Collapsed.
686	70×50×40	.....	Detached ovum.
694	40×10	13×7×7.....	Fibrous and necrotic.
720	90×30	(7 weeks).....	Mucoid villi.
726	60×40×30	(12 weeks).....	Few villi.
734	50×25×25	Collapsed ovum (2 weeks).....	Mucoid and necrotic.
741	70×50×40	18×6 (20 weeks).....	Fibrous and necrotic.
754	70×25×15	2×1 (1 week).....	Necrotic.
762	65×45×35	(6 weeks).....	Necrotic (scattered).
765a	75×30×30	5 (8 weeks).....	Necrotic.
772	30×30×15	(4 weeks).....	Degenerate (scattered).
773	55×20×15	.....	Fibrous (scattered).
775	70×40×35	Collapsed.....	Necrotic and fibrous.
777	75×55×55	5, collapsed (11 weeks).....	Few necrotic villi.
787	40×11×11	.....	Few fibrous villi.
794	60×20×20	None.....	Possibly a few trophoblast cells.
809b	60×40×30	.....	Few necrotic villi.
809c	80×45×35	Collapsed (1 week).....	Scattered necrotic villi.
815	50×30×25	Collapsed (5 weeks).....	Necrotic villi.
825	90×40×25	.....	Double ovum with quite normal chorion.
835	40×30×30	.....	Few scattered fibrous villi.
874	80×30×25	Ovum broken (7 weeks).....	Villi very active.
889	50×25×25	(6 weeks).....	
891	60×30×30	Ovum 10×5.....	Necrotic.
892	90×45×45	(11 weeks).....	Fibrous villi.



## ADDENDUM.

Since writing the above I have had an opportunity to examine 29 new specimens of tubal pregnancy; and this was done in such a way so as to test thoroughly the condition of the tube wall in each specimen. Most of the specimens came to me unopened and many of them were preserved in an approved manner in our laboratory.

As far as possible careful examination was made of the tube wall near its uterine end, in the neighborhood of the pregnancy, and at its fimbriated end. Examinations of the fimbriated end were not often possible, but in several instances they gave data of great value as regards the condition of the tube lumen (*e. g.*, Nos. 928, 939, and 967*a*).

Twelve of the 29 specimens came from the Philippine Islands, and in these the inflammatory reaction in the tube lumen would appear to be more extensive than in those obtained from the United States. In two-thirds of these the accompanying clinical histories show that there had been an infection and that adhesions were found at the time of the operation. In only one of the 12 cases (No. 938) is it stated that the patient's condition was normal, and in this case no change was found within the mucous membrane of the tube. The same condition of the tube was found in 2 other specimens (Nos. 911 and 953). In all of the rest of the specimens follicular salpingitis, outpocketings of the epithelial lining into the muscular wall, or both, were found in some position of the tube lumen. This pathological condition was found 17 times in the uterine end of the tube, 14 times in the region of the pregnancy, and 6 times in the fimbriated end, and, as stated above, in some portion of the tube in 25 of the 28 specimens. The twenty-ninth specimen consisted only of a normal embryo, the tube not having been sent with it.

It is evident, then, that the changes within the tube lumen are frequently circumscribed; sometimes it was necessary to examine a second block from the uterine end before a pathological change was found in it. In one case this difference was most pronounced, the tube at its entrance into the uterus being normal, whereas one centimeter nearer the point of pregnancy a most pronounced follicular salpingitis was found.

In specimens Nos. 900*f*, 908, and 939, both tubes were examined. In the first and second there were outpocketings or follicular salpingitis in the uterine end of the pregnant tube, similar conditions being present in the same region of the non-pregnant tube. In No. 939 follicular salpingitis was found at the point of pregnancy and in the fimbriated end of the non-pregnant tube. A more detailed study, with the utilization of serial sections, would no doubt show pathological changes in the mucous membrane of the tube in every case, but at present such a study is entirely out of the question. For practical purposes the examination as recorded in table 14 is most satisfactory.

To make the causal study of tubal pregnancy complete, it will be necessary to determine with greater accuracy the norm of the mucous membrane of the Fallopian tube for various periods in its history up to the menopause, and numerous specimens for a study of this kind have already been collected. Furthermore, it will be necessary to make complete bacterial examinations from tubal pregnancies in order to determine their relation to venereal diseases.

TABLE 14.—The main facts of 29 tubal pregnancies, Catalogue Nos. 9006 to 998.

Catalogue No.	Dimensions in millimeters.	Age in weeks.	No. of pregnancies.	Clinical history.	Condition of tube lumen.			Remarks.
					Uterine end.	At the distention.	Fimbriated end.	
9006	60×45×35	..	2	Pelvic pains, leucorrhœa.	Follicular salpingitis.	Outpocketings.	.....	No ovum found, but undoubtedly there was one.
900c	53×45×40	3	3 (?)	Adhesions	Outpocketings	.....	.....	Pathological embryo, 6 mm. long.
900d	50×50×50	4	..	Adhesions	.....	.....	.....	
900e	25×15×15	..	..	.....	.....	.....	.....	
900f	40×32×25	6	10	Adhesions	.....	.....	.....	Right tube, ruptured.
900g	40×15×15	6	10	Adhesions	.....	.....	.....	Left tube of same case.
900h	33×21×18	8	3	Adhesions	.....	.....	.....	No trace of ovum found.
900i	60×50×40	7	4	Adhesions	.....	.....	.....	Trophoblast cells present.
904	70×55×40	..	..	.....	.....	.....	.....	Embryonic remnant, 1 mm. long.
908	60×50×35	..	..	.....	.....	.....	.....	Pregnant tube.
910	24×24×24	4½	6	.....	.....	.....	.....	Opposite tube of same case.
911	65×33	..	..	Adhesions	.....	.....	.....	
919	65×40×25	16	1	Gonorrhœa (?)	.....	.....	.....	
927	50×20×20	1	2	.....	.....	.....	.....	
928	75×28×28	1	..	.....	.....	.....	.....	
932	40×30×25	3	1	.....	.....	.....	.....	
934	92×32×20	3	4	Gonorrhœa	.....	.....	.....	Pathological embryo, 6 mm. long.
938	45×20×20	8½	1	Normal	.....	.....	.....	Pregnant tube.
939	75×25×20	18	4	Adhesions	.....	.....	.....	Opposite tube.
939	56×14	18	4	Adhesions	.....	.....	.....	
945	.....	10½	4	.....	.....	.....	.....	Normal embryo, 37.5 mm.
953	35×20×20	..	..	.....	.....	.....	.....	Few villi in the clot.
967a	50×40×30	4	3	Gonorrhœa (?)	.....	.....	.....	
967b	60×35×30	9	3	Adhesions	.....	.....	.....	
967c	65×50×30	12	4	.....	.....	.....	.....	
974	40×20×20	3	10	Adhesions	.....	.....	.....	
977	45×25×20	8 (?)	1	.....	.....	.....	.....	
980	64×37×33	3½	1	Adhesions	.....	.....	.....	
982	51×42×36	3	2	.....	.....	.....	.....	Slab of umbilical cord, 2 mm. long.
985	85×65×40	9	5	Adhesions	.....	.....	.....	Embryo said to have been found at time of operation.
988	85×45×45	8	1	Uterus much enlarged	.....	.....	.....	

## DESCRIPTION OF THE INDIVIDUAL SPECIMENS.

### No. 109.

(Dr. Harvey Cushing, Baltimore.)  
Embryo CR 10.5, NL 11, AR 9.5 mm.  
(Plate 1, figs. 1, 2, 3, and plate 4, fig. 3.)

"The patient, a widow, had her last normal period in the latter part of September (1897). She thinks she was impregnated just before her November catamenia, which was very scanty and appeared in the middle of November. The operation, which was for supposed appendicitis, took place December 16, at 10 p. m."

At the operation the tube was found ruptured and from it an ovum, 30 mm. in diameter, protruded. This specimen appeared normal and upon being opened a normal embryo was found. In handling, the head became compressed a little, thus accounting for the slight injury of the midbrain. The specimen was first placed in dilute and then in 95 per cent alcohol. The embryo was stained in alum carmine, and cut into sections 20 $\mu$  thick. Sections were also made of the chorion through its attachment to the tube wall. These were stained in various ways.

The villi of the chorion are beautifully developed, with a delicate mesenchyme, to all appearances normal. Their epithelial covering is very extensive and the trophoblast grades over into a layer which covers the tube wall. At certain points the chorion and tube wall are separated, the opening being filled with blood. On the one hand is the tube wall with its epithelial lining, and on the other hand the villi butting up against the blood clot. When the trophoblast comes in contact with the blood clot, the cells invade it first as a layer and then as individual cells. These findings correspond with those of Bryce and Teacher in their young specimens. Between the outer border of the trophoblast and the mesenchyme of the villi are numerous characteristic groups of syncytial cells. The outer layer of the trophoblast not only permeates the adjacent blood clots, but also the wall of the tube, where it often forms layers encircling the blood lacunae. Apparently the trophoblast cells have invaded the blood sinuses of the tube wall; in places both trophoblast cells and characteristic endothelial cells lie side by side. Of course it might be possible to describe this outer layer as belonging to the decidua, but as the cells are identical in appearance with the other trophoblastic cells and very unlike the endothelial cells of the blood sinuses, this interpretation is excluded. Where the villi do not come in contact with the tube wall, its epithelial lining is intact; at the point of juncture between the tube, epithelial cells, and trophoblast, the former degenerate, while the latter are very active in appearance. Occasionally groups of leucocytes are seen, showing that these are also implicated in the process which is destroying the tube wall. Apparently no decidua is present. The villi appear normal; they have a clear cellular mesenchyme, in which are embedded numerous embryonic blood vessels. The embryo is also normal.

### No. 154.

(Dr. Boldt, New York.)  
Ovum 10 $\times$ 7 $\times$ 7 mm., found within a mass of blood with the uterine tube.

When it was cut into serial sections no trace of an embryo could be found, but the sections show that the chorion had been torn, though the edges of the tear were

rounded and infiltrated with mesodermal cells. The main wall of the mesoderm and the villi in the neighborhood of the tear were fibrous and atrophic. The rest of the villi were normal in appearance. The villi at the attachment of the mesochorion showed curious processes which in section make them look like "jacks." No amnion was found.

### No. 175.

(Dr. Boldt, New York.)  
Embryo CR 13, NL 13 mm.

This specimen came from an emergency case of tubal abortion, the patient having peritonitis at the time.

"The patient was supposed to suffer with acute dyspepsia; subsequently the condition was diagnosed as appendicitis. It was stated also that she had skipped her period 4 days, when a sound was put into the uterus and turned around several times, after which slight bloody discharge was present. Examination showed uterus slightly softened, perhaps enlarged, but owing to already existing peritonitis the conditions (?) could not be definitely mapped out in cul-de-sac. Moderate pouching, as though from intra-peritoneal period, was discerned. Face anemic; features pinched, as found in cases of beginning peritonitis. On right side, diagnosis, ectopic pregnancy with rupture of tube; operation 1½ hours later, proved to be tubal abortion. Abdomen full of blood; tube still bleeding freely, hence it was taken off with the ovary. The ovum is intact and the distal part of the tube shows beautifully where the ovum has been contained. The latter floated out with the blood when the abdomen was opened. Usually they are lost."

On June 10 Dr. Boldt sent the ovum. It was put in 95 per cent alcohol within 5 minutes after removal from abdominal cavity. The normal ovum measured 30 by 25 by 25 mm. and was well covered with villi. Normal embryo. Sections of the chorion are not satisfactory. The villi, which are embedded in a mucoid mass, are encircled by a thick membrane containing maternal blood vessels infiltrated with lymphocytes. Apparently the portion of the chorion sectioned is covered with a thin layer of inflamed tube wall, either giving rise to the peritonitis or due to it.

### No. 179.

(Dr. Ellen A. Stone, Baltimore.)  
Embryo CR 70 mm.

This specimen was found free in the abdominal cavity mixed with blood at an operation by Dr. Cushing. Normal.

### No. 183.

(Dr. Boldt, New York.)  
Embryo CR 28, NL 23 mm.

"I send you a specimen of tubal pregnancy in the course of abortion; at least I think that I was able to feel the embryo still in the tube about 1.5 cm. from the abdominal extremity. The clinical part is very peculiar, in fact probably unique. The patient had been having hemorrhages off and on for 3 weeks, accompanied by intense pain, so that her physician thought she would abort daily; she not aborting, counsel was requested with a view of removing the uterine contents. When I examined the

woman, two clots of blood, as big as my fist, escaped *per vaginam* and I was told that such profuse bleeding had been in progress for a week, moderate bleeding 2 weeks sooner. The patient was exsanguinated from loss of blood. The abdomen, too, showed that the bleeding, intra-abdominal, had been going on quite a while. It was full of blood; the bleeding from the tube could be seen very nicely. Some blood quite recent; blood very old, large clots of blood, probably 2 or 3 days old, were numerous. The oldest blood, which was in firm yellowish red clots, was on the floor of the pelvis. If you find anything to account for this typical picture, I would be pleased to get full particulars. It was suggested that it might be due to a *placenta prævia* in the tube."

Dr. Boldt sent a specimen of tubal pregnancy, in which the fetus of 2 months was found still within the tube. The great interest in this case lies in the fact that the operation was performed as the process of tubal abortion was taking place. The abdominal extremity of the tube is dilated to a diameter of 1 cm. The uterine end is completely occluded. The tube is 2.5 cm. in diameter at the thickest point. The patient had had bleeding for 3 months at irregular intervals, accompanied by cramp-like pains. During the week before the operation the bleeding was very profuse, so that the physician (who thought that the patient had an intrauterine pregnancy) said that she would abort. Large clots were expelled *per vaginam*. The patient was very anemic and suffered great pain. In the abdomen there was a large quantity of blood which had escaped at different times, as shown by the varying degrees of consistency; some clots were recent, bleeding having continued from the tube, while some were very firm and yellowish-red, the latter being on the floor of the pelvis. The bleeding for such length of time without completion of the abortion is the main interesting feature.

The entire tube is 85 mm. long and 38 mm. in diameter. The chorion fills most of the tube and the amniotic cavity is small, and encircles closely the normal embryo. The tube is open at its fimbriated extremity. In the folds of the fimbriae is a large quantity of blood. All stages of degeneration are found in the villi of the chorion.

## No. 196.

(Professor Brödel, Baltimore, Maryland.)

The specimen, hardened in formalin, contained two suspicious bodies which were cut into serial sections. One proved to be the embryo, greatly deformed, representing a stage about 3 weeks old. The tissues of the embryo were quite homogeneous, only the central nervous system being recognizable. One eye and a large blood-vessel could

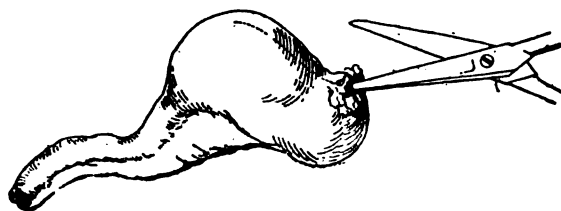


FIG. 1.—Outline of tube of No. 196, showing method by which it was opened.  $\times \frac{1}{2}$ . From a sketch by Mr. Brödel.

still be faintly outlined. At points the amnion and umbilical vesicle were blended completely with the chorion. The outside of the chorion had attached to it a few long

and thick villi which did not branch. The chorion and these villi were covered with a layer of syncytium of unequal thickness, which in many places had invaded the mesoderm. The whole chorion was embedded in a large mass of mother's blood. The most remarkable part of this specimen is found within the blood-vessels of the chorion. They are gorged with nucleated blood corpuscles filled with a pigment of the same color as that surrounding the mother's blood. It appears as if the syncytium, in destroying the mesoderm of the chorion and the mother's blood, at the same time made it possible for the blood of the embryo to take up the blood pigment thus liberated. At any rate, the blood of a human embryo 3 weeks old contains no pigment, and the sections of this specimen permit of this interpretation. There is also a considerable quantity of mother's blood within the ovum around the embryo, but as the specimen was opened before it was hardened and the corpuscles are all perfect, they need not be taken into consideration in the interpretation just given. The villi are covered with trophoblast, etc. On the outside of the clot is an extensive round-cell infiltration.

## No. 197.

(Dr. Little.)

Normal embryo (CR 117), 6 weeks old.

## No. 256.

(Dr. Mabel Austin, Boston, Mass.)

Embryo CR, 16 mm., AR 11 mm.

(Plate 6, fig. 1.)

On October 27, 1905, Dr. Austin wrote to Dr. Knower:

"I gave you two cat embryos and one human embryo. The former were in quite perfect condition, but the little human had lost one eye, due to the fact of its sticking to the dry sponge on which it was laid at the operation. We remarked at the time that its aspect was very animal-like and compared it later with the cat embryos which it seemed so much to resemble. My notes say that the human embryo measured about 2 cm. in length, while the cat embryos were larger. The following is a page from my notes:

"Mrs. W., aged 30. Para I, no miscarriages, child 8 years. Last menstrual period, January 10, 1904. Had regular flowing from that time until March 9, when she was taking with nausea, vomiting, and great weakness. She was operated upon March 10 at about 1 a. m. The fetus popped into view as soon as the abdomen was opened, floating on a mass of half-clotted blood. One uterine tube was found ruptured, with villi protruding through the aperture, which was 1 cm. in diameter. Microscopic examination of the tube wall showed it to be edematous, with foci of lymphoid cells. Some decidual cells and numerous well-preserved villi were found in the section. In the ovary, removed with the tube, was a large corpus luteum of pregnancy."

When the embryo was received it was found that the head had been injured and the midbrain and forebrain had escaped. A large hole over the eye shows where the brain had escaped from the head. The collapsed head makes the specimen look much like a cat, but the other features are human. There is no tail and there are twelve ribs. Normal.

## No. 294.

(Professor Brödel.)

Normal embryo, CR 35 mm.

## No. 298.

(Dr. Pearce, Albany, N. Y.)

Ovum about 4 mm. in diam.

(Plate 5, fig. 3.)

"I am sending a Fallopian tube removed at an operation on March 13. The tube shows rupture over an hemorrhagic swelling. The clinical diagnosis is rupture of an ectopic pregnancy. It is from a woman, age 26, married, who states that the last menstruation was 3 weeks before the operation. The surgeon is positive that it is a case of ectopic pregnancy. I am not so sure of the diagnosis."

On examination two nodules were found, each about 10 by 6 mm., one hemorrhagic, the other with hemorrhagic walls and villus-like bodies on it. The second body had a lumen—the oelom (?). Neither contained any trace of an ovum. The ends of the rupture were then cut into serial sections, and in one of them the remnants of the ovum were found. It is about 4 mm. in diameter, composed of small fibrous villi surrounded by trophoblast and blood. Some of the villi have been invaded by leucocytes.

## No. 307.

(Dr. H. C. Coe, New York.)

Pathological embryo, 20 mm. long.

One ovary and hemorrhagic ovum, 40 mm. in diameter, and a distorted embryo, 20 mm. long, were received. Sections were made through the tube-cell, chorion, and embryo. The hemorrhagic mass consists of blood through which are scattered long fibrous villi and mucous strands richly laden with round cells. They seem to grade with each other, thus showing all stages of degeneration of the chorion. The embryo is thoroughly dissociated and there are secondary changes in the cartilages, bones, and connective tissues. It must have been strangulated when the villi of the chorion ceased to supply it with nourishment.

## No. 314.

(Dr. R. M. Pearce, Albany, N. Y.)

Pathological embryo, CR 24, NL 18 mm.

Embryo removed from a gestation sac of a tubal pregnancy; the fetus under 3 cm. in length.

The embryo had been placed in formalin immediately after the operation. Serial sections show that it must have been dead for some time before the operation, as the tissues are macerated. In the connective tissues there are signs of dissociation and infiltration. Head small and atrophic.

## No. 324.

(Professor Brödel, Baltimore, Maryland.)

Pathological embryo, 3.5 mm. long. Ovum hemorrhagic and fleshy, measures  $45 \times 45 \times 22$  mm. Its walls are thin and lined with the amnion. Villi few in number, ramifying through the blood clot; some fibrous, being rich in cells; others show mucoid degeneration. There is very



FIG. 3.—Figure of the embryo found within specimen No. 324.  $\times 7$  times. (Drawn by Max Brödel.)

little trophoblast left. At certain points small knobs of syncytium are present, especially along the main wall of the chorion. It appears as if a renewed effort were being made to produce villi to take the place of those degenerated.

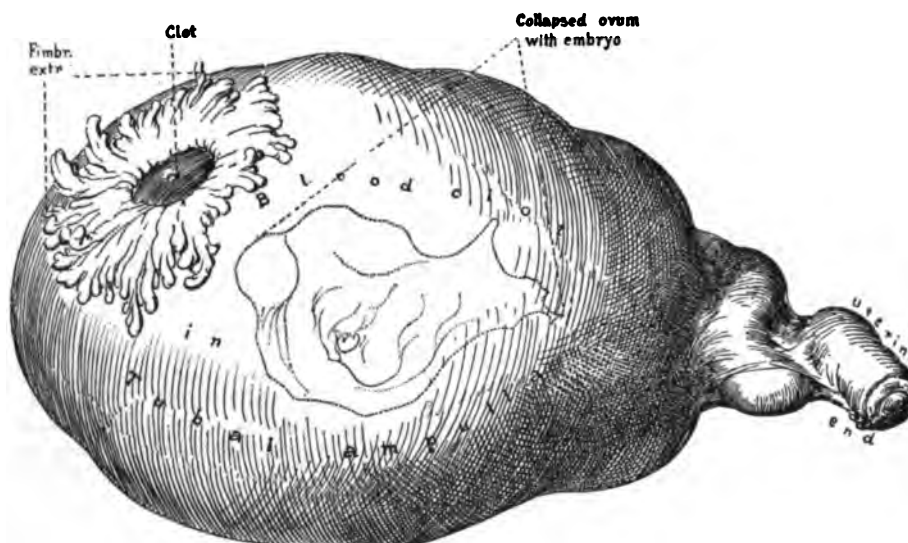


FIG. 2.—Figure of the distended tube of No. 324, with an outline of the ovum surrounded by the blood clot indicated with stipple.  $\times 1/1$ . Drawn by Brödel.

## No. 338c.

(Prof. C. S. Minot, Boston, Mass.)  
(Plate 6, fig. 4.)  
Distorted embryo of fifth week. Normal.

## No. 342.

(Professor Minot, Boston, Mass.)  
(Plate 5, fig. 2.)  
Pathological ovum,  $30 \times 20 \times 20$  mm.; pedicle within,  $5 \times 1$  mm. The specimen has a very thin fibrous chorion, with traces of blood-vessels, practically without villi. Within is a thickened fibrous amnion, to which the process, the umbilical cord, is attached. The cord is also fibrous, contains remnants of its blood-vessels, and has attached at its free end a curious group of round cells, which probably represents what remains of the embryo.

## No. 350.

(Professor Brödel, Baltimore.)  
Normal embryo, CR 15 mm., NR 12 mm.

## No. 352.

(Brödel Collection No. 36.)  
Embryo, CR 9, NL 9 mm. Specimen normal in shape, but macerated. Outline of organs sharp, which would go to prove that the specimen is normal.

## No. 361.

(Dr. Egbert, Washington.)  
Ovum, 10 mm. in diameter.  
"I am sending you what I think must be a 10-day ovum. I am indebted to Drs. D. Olin Leech and J. Thomas Kelley for the specimen, the case having occurred in Dr. Leech's private practice. The patient began her last menstrual period on April 15. Did not menstruate as expected on May 13. Attacked with severe pain, tenderness, and muscular rigidity in right iliac fossa on May 23. Operation refused. Patient grew rapidly worse until the afternoon and evening of May 26, when she was taken to the Sibley Hospital and consented to an operation, which was performed at 10 p. m. by Drs. Kelley and Leech. A mass of clot was found embedded in the pelvis and embedded in one of these I found the ovum. The tube was not ruptured, so that a tubal abortion must have occurred at the time of the sudden attack of severe pain on the 23d. Hemorrhage was still active, coming from the right tube near its distal end. Probably development ceased at the time of the abortion, as the ovum was entirely free from the tube. Considering the size of the ovum, impregnation must have taken place about May 13, 10 days prior to the abortion.

"The ovum was found in a mass of blood within the abdominal cavity, due to a tubal abortion. The operation was performed just 41 days after the beginning of the last menstrual period."

The specimen came after it had been in water for 24 hours. It was well covered with villi and filled with a mass of dense reticular and granular magma. No embryo could be found by direct observation. The specimen was macerated too much to allow careful microscopic examination.

## No. 367.

(Dr. Hunner, Baltimore.)  
Ovum,  $10 \times 7 \times 5$  mm.  
(Plate 4, figs. 1 and 2.)

"This is the specimen of April 24, 1906. Patient's age 33, married 14 years; two children, 12 and 11. Menstruation usually regular every 28 days; flow 3 to 4 days, scanty, no clots. At times intervals of six weeks between periods. Last period April 8, 1906. Since then constant daily spotting. Previous period March 12. Previous period, February 16. These two periods perfectly normal."

The ovum from a tubal pregnancy came to me unopened, and with some adhering cells and blood clot it was cut into serial sections. The chorion was torn on one side, but its interior was packed with a dense reticular magma. No trace of an embryo was found. The mesoderm of the main wall of the chorion was of normal thickness, but on the side towards the coelom it was not sharply defined. Frequently strands of cells were found partly separated and running out into the magma. The tissue of the mesoderm



Figs. 4 and 5.—Sketch of ovum and tube, with an additional figure of the clot which was peeled out of the lumen of No. 367. Above this there is a figure of the remnant of the ovum which was attached to the lower part of the clot near the abdominal end of the tube.  $\times \frac{1}{2}$ . From sketches by Prof. Brödel.

of the villi was not clearly defined as in normal specimens, some having undergone marked degeneration. The villi were developed better on one side of the chorion than on the other, and here they contained structures which were undoubtedly blood-vessels. The trophoblast was not well developed. However, at points where it had come in contact with blood clots the individual cells were wandering away from it. The surrounding tissue was full of fibrin and contained numerous fragmented nuclei and some blood.

It is natural to read into this specimen the following history: The embryonic mass grew long enough to send its blood-vessels into the chorion and then the nutrition was cut off because the villi did not attach themselves properly. That this was the case is shown by the capsule of necrotic tissue which encircles the villi. As a result of impaired nutrition the embryo was destroyed, leaving only the isolated chorion filled with reticular magma.

## No. 369.

(Professor Brödel, Baltimore.)

Ovum  $7 \times 3 \times 3$  mm. The specimen was removed by operation on October 9, 1906. The woman's last period began September 17. The distended tube measured 25 mm. in diameter and when cut open a small lump, 2 cm. in diameter, was seen on one side of its cavity. This was believed to be the embryo, but serial sections proved it to be a small mass of blood very rich in leucocytes. The sections show the chorion pretty well folded upon itself, and torn at several points. The torn edges are well rounded, that is, they have healed and are therefore not due to the operation. Only a few villi are left, and these, with the main walls of the chorion, are very fibrous in structure. There is but little syncytium present. The entire chorion is separated from the wall of the tube by a thick layer of blood, and the tube wall is well infiltrated with leucocytes. What is most remarkable in this specimen is that the amnion lines the chorion completely and all of the mesoderm of the chorion is well filled with blood-vessels from the embryonic mass, which must have been present at one time.

## No. 378.

(Professor Brödel, Baltimore.)

Ovum, 12 mm. in diameter. From a tubal pregnancy, dumb-bell-shaped. It had been opened by Professor Brödel, who found no trace of an embryo in it. It was hardened immediately and later cut into serial sections. At no point in the sections could any trace of an embryo be found, although it is possible, but improbable, that it was lost while the fresh specimen was being examined. The coelom contains some granular magma. The mesoderm of the main wall of the chorion is apparently normal, but that of the villi is edematous. There are no blood-vessels present. At many points the syncytium is necrotic, frequently rising from the villi, leaving small vesicles below. The necrotic masses are held together by a slimy mass, within which there are a great many small round cells, undoubtedly leucocytes.

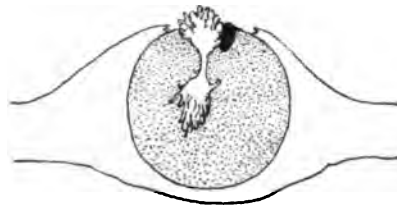


FIG. 6.—Diagram showing relation of the ovum to the tube lumen, which is ruptured and filled with blood. Natural size. (No. 378.)

## No. 389.

(Dr. Casler, Baltimore.)

Embryo, CR 8, AR 8, GL 9 mm. Normal. Tubal abortion occurred several hours after severe hemorrhage. Large clots were found in the peritoneal cavity. These with the tube which was removed were placed in formalin. Before the clots were examined a normal embryo was found among them. It was surrounded by the amnion, but only a few villi were present. Sections show that the embryo is normal.

## No. 390.

(Professor Brödel.)

Embryo, CR 15.5, AR 11.5 mm.

## No. 396.

(Dr. Casler, Baltimore.)

(Plate 5, fig. 1.)

Ovum, about 7 mm. in diameter; within the coelom a body measuring  $2 \times 1$  mm.

"The tube was removed April 24, 1907, from a woman 21 years old. Last period, March 5, followed by a brownish discharge on April 11. Diagnosis of tubal pregnancy on April 23. The abdominal cavity was found well filled with blood and the tube was still bleeding through the internal ostium. The whole tube was removed and placed in a 10 per cent solution of formalin."

The hardened tube is 40 mm. in length and 20 mm. in diameter. It was cut into blocks 5 mm. thick and imbedded in celloidin. Two of the blocks were found to contain the ovum and these were cut out and reembedded in paraffin and cut into serial sections. The sections show that the ovum has unusually long villi, fully 5 mm. long, which ramify throughout the blood in the tube and in many instances are attached to the decidua. The trophoblast is well developed. The walls of the tube are markedly distended and infiltrated with red corpuscles and leucocytes. Many contain fragmented nuclei, which are also scattered throughout the decidua. Within the coelom of the chorion there is a double vesicle, the large one,  $2 \times 1$  mm. in diameter, showing all the characteristics of the umbilical vesicle. Its layer of mesoderm appears to be thickened and at numerous points it has become adherent to the inner wall of the chorion. At these points the blood islands extend over to the mesoderm and from them blood-vessels ramify to all of the villi. These vessels are all filled with nucleated blood cells. The smaller vesicle is about a millimeter in diameter, is lined with cylindrical cells, and is covered with quite an even layer of mesoderm, in which there are some quite large blood-vessels, but no blood. Towards one of its ends it is covered with a marked layer of cylindrical cells. It may be that this second vesicle represents what is left of the embryo. Around these two vesicles, filling the whole coelom, there is a dense reticular magma. The main wall of the chorion and many of the villi are somewhat fibrous in structure. Some of the villi are being invaded by syncytial cells.

This specimen is especially valuable, inasmuch as it shows the early changes which take place in an ovum after it has become lodged in the uterine tube. No doubt, owing to its faulty implantation, the nutrition of the embryo was affected and it consequently grew in an irregular fashion. The umbilical vesicle became adherent to the chorion and its blood-vessels grew out into most of the villi. The trophoblast is active in places and wanting in others (?). Apparently the ovum has been only partly implanted. Some villi are fibrous and denuded, some show mucoid degeneration, and others are normal and well implanted into the tube wall. All stages of destruction of the villi are seen and in many places they are being destroyed by leucocytes. Elsewhere the trophoblast is extensive and many of its single cells are wandering into the blood clot.

## No. 415.

(Dr. Casler, Baltimore.)

Villi in tube. The unruptured tube is  $40 \times 20 \times 20$  mm. and filled with a blood clot. The operation took place 6 weeks after the last period. The entire tube was hardened in formalin and then cut into blocks. The region containing villi was then cut into serial sections. There are a few villi almost hydatiform and there is extensive mucoid

degeneration of the mesenchyme. The trophoblast is scanty, often necrotic, as in fact are often the whole villi. A few of the villi which have extended into the tube wall are actively destroying the surrounding tissue with their growing trophoblast. No coelom was found.

## No. 418.

(Dr. Casler, Baltimore.)

A few fibrous villi. Tube removed 5 weeks after beginning of last period. The unopened tube was fixed in formalin and measured 50×25 mm., then cut into slabs, and the part containing the villi was cut into serial sections, every tenth section being mounted. Remnants of a degenerating ovum were found, with very fibrous chorion and villi infiltrated with lymphocytes. The strangulation of the ovum seemed to be complete.

## No. 422.

(Professor Brödel, Baltimore.)

Embryo, CR 9, NL 9 mm. Normal. Ovum 30 mm. in diameter. Tissue not well preserved.

## No. 426.

(Dr. Hunner, Baltimore.)

Embryo, CR 10, AR 8, NL 8. Normal. Patient's age 36. II para 13, 8; no miscarriages. Operation, October 8, 1905. Ruptured ectopic pregnancy. Last period due Saturday, September 30. Went to Doctor October 1, and asked him to bring on flow. Some flow on October 2. On Wednesday, October 4, Doctor dilated uterus and that night patient had signs of general peritonitis. I operated October 8 and found fetus floating from its sac in the abdomen. Free blood.

## No. 430.

(Dr. Casler.)

(Plate 2, fig. 6.)

Unruptured. 60×35×35 mm., with a cavity 25×20×15 mm., filled evenly with a dense reticular magma. On one side is a small nodule which in sections appears to be a particle of granular magma. Chorion fibrous, no amnion, the villi are for the most part degenerated. Trophoblast scanty. At certain points are large masses of chromatin granules, which no doubt represent the nuclear remains of the syncytium.

## No. 431.

(Dr. Griffith, Baltimore.)

Embryo, CR 19, AR 12 mm. The unopened tube 60×45×35 mm., with an amniotic cavity 30×25×25 mm., lined with a smooth membrane and encircled with much magma reticulé. The embryo was cut into serial sections and found to be normal in every respect.

## No. 432.

(Dr. Chambers, Baltimore.)

Normal embryo, CR 18.5, AR 12.5 mm.

## No. 448.

(Professor Brödel.)

Normal embryo, CR 52 mm. Sections of the embryo, which had been injected fresh, indicate that the embryo is entirely normal.

## No. 449.

(Dr. T. Cullen, Baltimore.)

Normal embryo, CR 36 mm. Obtained alive. Dr. Evans injected the blood-vessels at once. Cut into serial sections.

## No. 456.

(Dr. Hunner, Brödel Collection.)

Embryo, CR 19, AR 14 mm. Ovum 45×28 mm.

Patient aged 31. I para, 15 years old. No miscarriages. Expected period November 13. None; more or less pain in the right side, feeling of pressure, nausea and vomiting. Three days before coming to hospital severe pain in right side. Took to bed; nausea and vomiting. No mention of bleeding in history. Conditions at the operation indicate that the blood clot is older than 3 days.

## No. 458.

(Brödel Collection.)

Normal embryo, CR 54, AR 39 mm.

## No. 472.

(Dr. T. Cullen.)

(Plate 2, fig. 2.)

Hysterectomy for pelvic inflammatory disease. Villi of the chorion found in one tube. Two blocks embedded in celloidin and the entire uterus sent to the Anatomical Laboratory. Three blocks were cut and in one scattered villi, fibrous and well degenerated, were found in the tube lumen near its fimbriated extremity. These lie within a cleft in the thickened tube wall. A few large glands in their neighborhood make one suspect that the section is through the uterus or near to it. The muscular wall is unusually extensive for the tube also. At no point do the villi connect with one another nor with the main wall of the chorion; they are independent. Trophoblast present at parts and invades the muscular tissue. The epithelial "glands" are scattered in the muscular tissue and may represent an attempt at regeneration of the tube wall.

## No. 477.

(Dr. A. Miller, Portersville, California.)

Pathological embryo, 5 mm. Tumor mass.

"Age 24. Last baby born April 5, 1908. When baby was 6 weeks old the patient flowed freely. Then there was slight staining during May and June. Nothing was seen during July and August. Became unwell September 1, flow scanty; again in October and flowed freely. Menstruated again about November 16; again December 16. Flowed again January 13, at which time she had severe abdominal pains, cramplike. The patient became very pale and the abdomen was distended and tender. There has been a blood-stained vaginal discharge since January 30, 1910. Laparotomy. Removal of left tubal pregnancy."

The embryo is in a small cavity, 10 mm. in diameter, irregular in form, about 5 mm. long. Sections show that it is markedly changed, being dissociated and possibly macerated. The body wall is greatly thickened. Sections of the tube show beautiful villi, active at some points and degenerating elsewhere. Trophoblast scanty. The main wall of the chorion has small tufts of epithelial cells upon it; at one point it is thin and nearly perforated, being invaded by leucocytes.



No. 478.

(Dr. A. Miller, Portersville, California.)

Embryo, CR 22.5 mm.

"Aged 26. Four months ago the patient felt as if something were pressing against the rectum and as if the bowels must move. One month later she had another attack. During the following week there were three such attacks. Then the discomfort changed to pains like labor pains. Such pains have occurred at intervals to date. Patient has had three children, the youngest 2 years old. The baby was nursed 14 months. Menstruation occurred every month during lactation and continued regularly for 5 months after, that is, menstruation was regular up to and including June 1909. July was missed. In August, 3 months ago, after going 2 weeks over time, she passed a clot and flowed freely. She menstruated again in September. Three weeks ago she had morning sickness for a week. November 27, 1909. Laparotomy. Removal of left extra-uterine pregnancy."

Tumor mass  $85 \times 60 \times 45$  mm. Within, a displaced pregnancy with a well-marked amniotic cavity just large enough to hold the embryo. Sections of the wall of the cavity showed villi curiously and evenly embedded in blood with an inactive trophoblast and round-cell infiltration of the mesoderm. It appears as if the embryo had been dead for some time, and although normal in form, does not look natural. The tube wall is markedly infiltrated with leucocytes, that also invade many villi. Irregular masses of trophoblast scattered all through the specimen. Lumen of outer end of the tube is filled with a fibrinous clot which is organizing.

No. 479.

(Dr. T. Cullen, Baltimore.)

Pathological fetus, 80 mm. long.

Dr. Cullen writes: "A patient of Dr. Jump; came to see me on January 9, 1911. She has had two children, one miscarriage. Her menstrual history began at the usual time and was regular; the flow was free and without pain. She did not miss any period, but since October the flow has been almost continuous. It would cease for a day or two and then reappear. There has been almost continual pain in the abdomen. It hurts her to sit down or to lie down. There has been no fever. Four years ago she first had an attack of appendicitis. Since then there have been several attacks, the last one just before Christmas of this year. On pelvic examination I could feel the uterus in normal position. To the right was some thickening, to the left and continuous with the uterus a mass about 3 times the natural size of the uterus. To the medical men assembled I said that the history was that of extra-uterine pregnancy. Bimanual examination suggested myoma. On opening the abdomen we found to the left of the uterus a dark reddish-blue mass about 7 cm. in diameter. Over its surface were congeries of congested vessels. It proved to be the left tube. On the surface were a few brown clots, much browner than I have heretofore seen. They were leathery in appearance. We removed the left tube and ovary. The right tube was adherent to the appendix. The ovary was normal. We removed the appendix and drained through the vagina. The patient stood the operation well. I regret exceedingly that I can not give you a definite menstrual history, but there was none. Some of our patients miss one period and then commence bleeding; others have a period that is rather tardy, but that continues intermittently without any definite missing of the period."

The ruptured tube mass measures  $90 \times 70 \times 70$  mm. The fetus protrudes. It is flattened and edematous, one

foot being more swollen than the rest of the body. Evidently it has been dead for some time. Its condition must be accounted for by changes in the circulatory system. The fetus is adherent to the chorion by a band of tissue which reaches from the wall to the neck. The chorion is necrotic, its mesoderm being edematous and the trophoblast is irregular and scanty. At some points it is invading the mesoderm of the syncytium. Sections of the leg of the fetus show marked changes in the bone; the epidermis has fallen off and the skin is infiltrated. All these changes can be accounted for by the death of the fetus, which must have occurred at the time of the rupture of the tube.

No. 481.

(Dr. T. Cullen, Baltimore.)

Normal fetus, 57 mm. long. Obtained two hours after the operation. The blood vessels were injected with India ink.

No. 484.

(Dr. T. Cullen, Baltimore.)

Normal fetus 96 mm. long. Injected with India ink two hours after operation. It came in a distended uterus-shaped tube,  $110 \times 100 \times 80$  mm. Apparently normal. Beautiful large villi with scanty trophoblast. Its blood-vessels are distended with blood and the mesoderm is quite rich in nuclei. At its juncture with the tube wall the trophoblast is active and is invading the wall of the tube.

No. 487.

(Dr. R. B. Slocum, Wilmington, North Carolina.)

Normal embryo, about 11 mm. long.

"I am sending part of an embryo from a case of extra-uterine pregnancy which had ruptured into the abdominal cavity. The woman menstruated regularly December 20, 1910, and the rupture occurred January 22, 1911. It was broken and put at once into 95 per cent alcohol before I knew it."

No. 488.

(Dr. Hunner, Baltimore.)

(Plate 5, fig. 4.)

Ovum about 5 mm. (?) in diameter.

On January 25, 1911, Dr. Hunner sent the following: "Since the operation in July 1910 the periods have always been over one week late. In December she was visiting in New Orleans and her period came two weeks late. It began December 11 and she menstruated normally for 3 days. The first intercourse after this period was December 16, on her return from New Orleans.



FIG. 7.—Outline of the tube which has been cut off sufficiently to free the ovum (No. 488).  $\times \frac{1}{2}$ .

Intercourse took place one or twice a week until the January period, which began January 16, 8 days late. The first day of the period she walked a great deal and got chilled and that evening the period had almost stopped.

On January 17 she noticed that the period was not like her normal flow, and on January 18 there was only a little brownish discharge. I saw the patient January 19, and she complained that the breasts had remained sore and swollen. Pelvic examination showed the left ovary

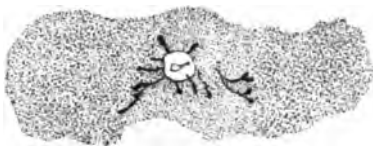


FIG. 8.—Clot containing the ovum which was removed from the tube lumen (No. 488).  $\times 2\frac{1}{2}$ .

adherent to the left broad ligament, and tender. No mass could be felt in the tube region. The patient was kept under close observation and continued to have more or less spotting until January 25, the day of operation. The tube was found non-adherent and contained the specimen sent you. The corpus luteum of pregnancy in the left ovary had unfortunately ruptured during the pre-operative examination.

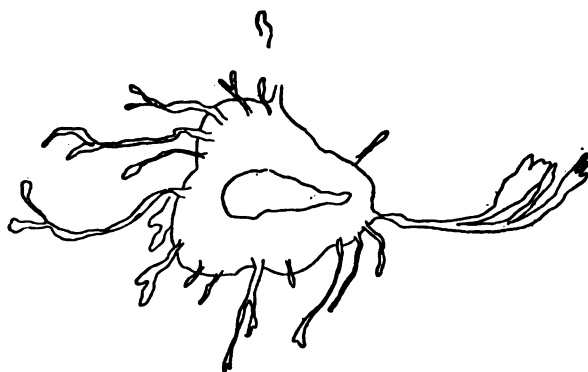


FIG. 9.—Outline of the ovum, which is covered with straggling villi (No. 488).  $\times 8$ . (Sketches by Professor Evans.)

On February 28, 1911, Dr. Hunner wrote: "The history of the patient whose ectopic specimen you got on January 25 is as follows: I saw her first May 18, 1908. She was 26 years of age and had been married five years and had had an abortion performed at four months, one year after marriage. Apparently this had produced an infection. A few months after the abortion she had two separate attacks, about 6 months apart, of agonizing pain in the lower abdomen accompanied by fever. Drs. Osler and Russell saw her in these attacks and considered them due to the appendix. Two years after the last attack she consulted me concerning a constant heavy weight in the lower abdomen and because of a desire to become pregnant. I found the pelvic organs bound back on the floor of the pelvis by adhesions.

"Menstrual history: Periods occur on time or 7 to 10 days late, 4 to 5 days flow, moderate—at times has to go to bed for a few hours, because of pain in epigastrium and over entire abdomen. In April 1909, while visiting in Boston, she had another attack, considered to be appendicitis. On May 12, 1909, I operated, removing an appendix which was undergoing fibrous degeneration; I freed the uterus, tubes, and ovaries from adhesions and brought them into position by bringing the round ligaments through

the recti muscles (Gilliam method). The tubes and ovaries were so fastened to the pelvic floor as to make a complete covering for the fimbriated ends of the tubes. By brushing off these adhesions in the act of freeing the structures the fimbriated ends were found to be open. The tubes were somewhat thickened and I made a note at the time that conditions were favorable for ectopic pregnancy.

"Operation July 28, 1910. Unruptured ectopic pregnancy right tube. On July 18, the patient began to have an abnormal spotting of dark, thick material which persisted off and on every day for the intervening 10 days. Her period was one week late, but this was not unusual for her. She always had tender, swollen breasts for some days before the period and normally this disappeared after the first day or two of flow. On this occasion the swelling and tenderness had persisted for the 10 days of spotting. She had had a queer feeling in the right side of the pelvis. A small, soft, tense mass was felt in the region of the right tube. Operation revealed near the outer end of the right tube a small swelling about 1 cm. in diameter and 2 cm. long, evidently a tubal pregnancy. The tube was removed. At this operation the left tube was found considerably kinked by adhesions and would have been removed had the patient not been so anxious to become pregnant. So far as possible the adhesions were gently freed."

The tube, considerably swollen in its middle portion, came to us fresh from the operating room. It was opened over the area of enlargement in warm salt solution under the binocular microscope, the coats being carefully dissected apart until the tube lumen was reached. Nothing suggesting a placenta was found, but a large blood clot lay practically free in the lumen. By careful manipulation of the tube from the exterior the blood mass was completely evaginated and freed from the tube, the interior of which was not touched. The lumen was then carefully laid open from the area in question through to the fimbriated extremity. The whole was fixed in Zenker's solution, in which the acetic acid was substituted by 10 per cent formalin (4 per cent formaldehyde) for 24 hours, after which the blood mass was explored and the ovum found and opened, the fixative continuing to act for 8 hours.

Alcohol: 35, 40, 45, 50, 55, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, etc., to absolute alcohol (4 hours in each).

The specimen, which had been carefully fixed, was cut into blocks, as shown in the figure, and sections were taken from each part. From block No. 6 serial sections were taken. The lumen of the tube is nearly obliterated at its uterine extremity, and towards its fimbriated end the folds become more and more marked. In region 6, these folds cut the tube into many compartments and where the ovum is located the folds are very large and have large blood-vessels in them. In this region there are peculiar cells—possibly decidual—in the connective tissue. The blood mass is cylindrical in shape and measures  $31 \times 12$  mm. Near its center the ovum is lodged. This was carefully cleared of blood and found to contain long, irregular villi, some of which measure 3.5 mm. The ovum was opened by Dr. Evans, who noted that it was filled with an amorphous mass. Nothing resembling an embryonic rudiment or an embryo was seen. This mass was subsequently cut into serial sections.

The mesoderm at points seems to be necrotic. No blood-vessels are encountered. The interior of the ovum is filled with granular magma. But little trophoblast is present. Within the coelom curious hyaline bands are seen intermingled with maternal blood corpuscles. The mesoderm of the villi is partly fibrous and partly granular. In the latter case there are only a few nuclei present.

## No. 495.

(Dr. C. F. Davidson, Easton, Maryland.)  
(Plate 6, fig. 3.)

The specimen, which has been cut open, measures 30×25×25 mm. The cavity within, which has been cut into, was about 6 mm. in diameter. On one side of the cavity is a small nodule which, when sectioned, is found to be a clot of blood. No embryo is found. The cavity is lined with a smooth, fibrous membrane, the chorion; there is no amnion. The villi are also very fibrous, being covered with a scanty trophoblast. Between the chorion and the wall of the tube, which is very thin, is an organizing clot of blood. Scattered through it there are groups of chromatin granules from syncytium and also of leucocytes. At points the syncytium is invading the mesoderm of the chorion.

## No. 496.

(Dr. Lee, New London, Conn.)

Normal embryo, CR 18 mm. Patient 37 years of age, 7 years previously had been delivered of a normal child. The present illness was believed to be due to a tubal pregnancy of about 6 weeks duration. A ruptured tube was found on the left side and an embryo 18 mm. long. One ovary was removed. The chorion was free and appeared to be normal. It was not cut. Sections of the tube wall show that very few fibrous villi were present.

## No. 497.

(Dr. Walter Tobie, Portland, Maine.)

Embryo, normal, CR 43 mm. Ruptured. The tube wall was sent to me.

## No. 503.

(Dr. Hunner, Baltimore.)

Normal embryo, CR 13 mm., AR 11 mm.

"Mrs. D., age 28 years, admitted to the Johns Hopkins Hospital May 9, 1911. Clinical diagnosis, ectopic pregnancy right side. Has two children, youngest 3½ years old. She last had her menses normally on February 6. The following week, three weeks ago, she began to bleed and has been bleeding ever since. Has passed no clots, but the blood manifests itself as a stain and is not much in quantity. Since the onset of this bleeding the patient has had intermittent cramp-like pains in the lower abdomen, of from five to ten minutes' duration. On account of these she has been in bed for the last two weeks. Her stomach is intolerant of medicines. Before the peritoneum was opened through a median-line incision a blood clot was made out beneath. The right tube was large and distended with blood clot. The tube was removed and opened, the blood clot was exposed, and in it a fetus was found. The appendix was then exposed; it was long, thickened, bulbous at the end, and bound up in adhesions.

The mass measured 50×40×30 mm. The specimen had been in salt solution all night in a cool place. Next morning it was fixed in formalin. The tube was well ruptured, and the chorion, which was hemorrhagic, was exposed. Amnion about 15 mm. in diameter. Head of embryo crushed, but specimen appeared normal. The sections are hard to interpret. The folds of the tube are very large; in them may be seen great blood sinuses. The organized blood as well as the tube wall is being invaded by trophoblast. Villi irregular, with extensive trophoblast and syncytium. Some villi degenerating and invaded by leucocytes. Main wall of chorion thin and covered with syncytium.

## No. 507.

Ruptured tubal pregnancy brought from the Johns Hopkins Hospital by Dr. Evans. Specimen 50×35×30 mm., its cavity lined with a smooth membrane. No embryo found. Tissues quite hard, and do not stain well; apparently necrotic. History and specimen unsatisfactory. No follicular salpingitis on fimbriated side of ovum.

## No. 513.

(Dr. T. Cullen.)

Unruptured. Placed immediately in strong formalin. It measures 70×30×30 mm. Later it was cut into slabs and in one of them was found a collapsed ovum. At one point some of the villi of the chorion were quite free. The coelom was filled with granular magma, and within it there was a sac, about 6 mm. in diameter (the amnion). No embryo found. The clot was well organized, being also encircled with a wall of leucocytes. Ovum collapsed, the villi irregular and fibrous, some long and slender and ending as a club. Trophoblast scanty; at some points it had degenerated completely, leaving a hyaline mass with granules of chromatin. Some showed a mucoid degeneration. Others had been invaded by trophoblast or by leucocytes. All kinds and stages of degeneration were apparent. There were blood-vessels in the chorion. Outpocketings in middle portion of tube.

## No. 514.

(Dr. Harvie, Troy, New York.)

The tube measures 15×8×8 mm. and contains a small clot. Hardened in formalin. Sections show a few degenerate villi, some only as shadows, others hyaline, and a few with a number of buds of syncytium. Trophoblast scanty, often missing entirely.

## No. 515.

(Dr. Ernest Cullen.)

Ovum 17×14×11 mm. Operated upon by Dr. Cullen, April 13, 1911. Patient colored, age 33 years; was in collapse; hemoglobin 20 per cent. Ruptured ectopic pregnancy was suspected. The peritoneum was full of blood; the tube was found ruptured near the isthmus. Many clots and apparent placental fragments were floating free. The left (?) tube and ovary were removed. Among the free fragments an ovum (about 12×15 mm.) was discovered; it showed many branched, rounded villi, averaging 1.5 to 3.5 mm. in length. An apparently normal yolk-sac, 3×5 mm. (?), with vessels. No trace of embryo. Specimen in bichloride acetic. (Beautifully fixed material.)

The specimen shows villi normal in shape. It had been split open by Dr. Evans. Repeated examinations revealed only a smooth internal surface without amnion or embryo. It was stained *in toto* and cut into serial sections. There are blood vessels in the chorion but no amnion; possibly there are some remnants of an embryo. The villi appear to be fibrous, the trophoblast is scanty, and some of the syncytium has undergone hyaline degeneration. Corpus luteum apparently not normal; infiltrated with round cells which often look like the follicles of the lymph gland. Sections of tube normal.

## No. 517.

(Dr. Sommer, Trenton, New Jersey.)

"The history is indefinite, as the patient does not speak English and the data were only imperfectly obtained through an interpreter. Age 34, Italian, multipara, married 5 years. One year ago she had pelvic pain,

evidently from a peritonitis. Menses regular. Four months ago there was a recurrence of pain, but no irregularity of menses. The uterus is retroflexed and adherent. There is tenderness up to the left, where a cystic movable mass is felt, anterior to the uterus. Abdominal section April 2, 1911. There was free blood in the abdominal cavity and signs of an old pelvic peritonitis. On the left side was a thin-walled tube on the point of rupture. This ruptured and an organized clot was extruded, in the middle of which a set of membranes were found attached. The right tube was closed and filled with altered blood and adherent. Mass  $40 \times 30 \times 30$ . Within there is a deep cavity containing a vesicle and a folded amnion, both attached to the chorion at the same point. The cord is broken and appears normal; no embryo found. Sections show a granular mass in the vesicle. The chorion and amnion appear normal, the former containing blood-vessels. The villi and trophoblast show marked changes, hyaline degeneration of the syncytium with destruction of its nuclei often appearing as a mass of bacteria (?). From the appearance one would say that normal development had gone on until a short time before the operation, when the specimen became 'detached' or 'strangled.'

## No. 519.

(Dr. Hunner, Baltimore.)

(Plate 6, fig. 7.)

Unruptured. The kinked unopened tube with one ovary was sent to the laboratory. An organized clot found in the tube measured  $25 \times 20$  mm. There was an open cavity in the ovary. Sections show only a few scattered fibrous villi in the organized clot. At some points large masses of leucocytes occur; at others these few trophoblast cells are invading the clot.

## No. 520.

(Dr. Harvey, Troy, New York.)

Unruptured. The tube was distended with a large clot, which peeled out easily. It measures  $60 \times 35 \times 30$  mm. On the outside of the clot is a gelatinous mass  $5 \times 3 \times 3$  mm., which in sections appears to be the remnant of the ovum. From this a long fibrous process, a villus, enters the clot. Other fibrous villi are present: the leucocytes segregate in the middle of the clot.

## No. 524.

(Dr. E. Cullen.)

The mass measures  $70 \times 60 \times 50$  mm.; within it has a cavity, 25 mm. in diameter, lined with a smooth membrane, to which is attached a hemorrhagic mass. This is 14 mm. long and continuous with a gelatinous cord, 15 mm. long and 2 mm. in diameter. The wall of the chorion is well defined. It is lined with the amnion, and the umbilical cord ends in a membrane which may represent the body wall of the embryo. There are definite blood-vessels in the cord and in the chorion. It appears as if the embryo had reached an advanced stage of development, and then had been destroyed by trauma or otherwise. The villi of the chorion are all in a partly organized clot with many leucocytes and trophoblast cells scattered through it. At some points long streams of trophoblast run from the villi through the clot into the wall of the tube, where they line a blood sinus. The villi are very irregular in form, often denuded of trophoblast and invaded by leucocytes. At other points are beds of syncytium. Follicular salpingitis.

## No. 535.

(Dr. R. B. Slocum, Wilmington, N. C.)

Embryo CR 11 mm. The tubal mass measures  $60 \times 55 \times 50$  mm. and is unruptured. It is lined with a smooth membrane, both chorion and amnion, and contains a distorted, but apparently normal, embryo. There are no external branchial arches, the ribs are easily seen and the eye measures 0.6 mm. The tube wall and the chorion is one thick organized clot with villi in all stages of degeneration. The inflammatory process has invaded the entire tube wall—that is, the villi are almost destroyed. They are irregular and have but little trophoblast over them. No blood-vessels are in the villi, although numerous free blood-cells are in the meshes of the mesenchyme. Much of the trophoblast is necrotic.

## No. 539.

(Dr. Mayo, Baltimore.)

A multipara, 27 years old, came complaining of pains in the left side. The period was one day overdue, but has always been irregular. The specimen has been somewhat injured. The tube is 40 mm. long and 8 in diameter. At certain points a blood clot is protruding from the lumen. Sections show a well-organized clot with much fibrin and many leucocytes. In the clot are scattered degenerated villi of irregular size, some distended and decidedly mucoid in nature, others fibrous. There is very little trophoblast present, and many of the villi are being invaded by leucocytes.

## No. 540.

(Dr. Mayo, Baltimore.)

(Plate 6, fig. 6.)

The patient is 35 years old and has had one child, 10 years old. A year ago she had acute pelvic inflammatory disease, and since that time has had continuous bleeding. An operation for chronic pelvic inflammatory disease was instituted, and a tubal pregnancy was found. The unruptured tube, measuring  $50 \times 16 \times 16$  mm., was hardened *in toto*. It was filled with a blood clot, 14 mm. in diameter. The blood clot fills the lumen of the tube and with it is a small collapsed ovum. Irregular villi ramify from it throughout the clot. Within the clot they are fibrous, but at its periphery they have an extensive and active trophoblast, which encircles the tube wall as well as the clot. The tube wall also contains masses of leucocytes, and is being destroyed rapidly. Outpocketings in uterine end of tube.

## No. 553.

(Dr. Roeder, Grand Island, Nebraska.)

A Syrian, age 26, nursing her first child, which is now 13 months old. Started menstruating four months ago. Had two periods and then missed two. Operated on November 8, 1911, for pain in left lower abdomen. Blood clots were found in the peritoneal cavity. The left tube of a pregnancy of about 2 months was removed. It measured  $50 \times 23 \times 23$  mm. and contained a clot  $30 \times 15$  mm.; this appears to contain a collapsed ovum. Sections show that the ovum is collapsed; in one section it is hourglass-shaped. Irregular villi with a scanty trophoblast are scattered through the organized clot. There is some trophoblast in the tube wall. This ovum had failed to remain implanted. There were no embryo blood-vessels in the chorion. Mucous membrane of fimbriated end normal.

## No. 554.

(Dr. W. B. Hetfield, Brooklyn, New York.)

50×20×20 mm. nodular embryo, 1 mm. long. Unopened tube sent fresh. It was placed in formalin at once and later cut into blocks. The clot within is closely adherent to the tube wall, and contains a cavity 20×10 mm. At one point in the coelom is a flattened nodule, composed mostly of round cells, and undoubtedly the remnant of the embryo. The villi are irregular, fibrous, and degenerating; some are necrotic. The chorion contains blood vessels. There is not much trophoblast and the leucocytes are very numerous, often invading the villi.

## No. 561.

(Dr. Sperry, Baltimore.)

Operation January 8, 1912. Menses regular until October 17; then the period was missed until November 27. Profuse bleeding for the last few days. No decidua found in the uterine scraping. There was a tubal pregnancy near the uterine end. The tube measured 28×22×22 mm. It was cut into blocks after it had been hardened in Zenker formalin solution. Within was a collapsed ovum. Part of the villi had degenerated and blood had entered the coelom. There were no blood-vessels in the chorion. The villi were partly fibrous and partly mucoid; where they reached the tube wall some were well formed and covered with trophoblast. The chorion was well implanted in the tube wall, but most of it lay in its lumen. There were, however, cyst-like spaces in the wall lined with epithelium, which were possibly pockets from the lumen of the tube. A curious granular mass stained intensely with hemotoxylin was present among the villi. Similar masses were seen in other specimens. Strands of fibrous mesenchyme extended into the coelom. These possibly represent the remnants of the embryo. Multiple lumina in uterine end of the tube.

## No. 567.

(Dr. T. Cullen, Baltimore.)

(Plate 2, fig. 5; plate 7, fig. 1.)

Embryo 5 mm. long.

"Admitted to the Church Home, January 31. The periods began at 14 and have always been regular, coming at intervals of 21 days and lasting about 5 days. There has been no history of intermenstrual bleeding, nor other disturbances with menstruation. Her periods have been at times associated with some backache. Present illness: About 2 weeks ago the patient began to menstruate, the previous period having been 3 weeks before, no longer time than this having ever elapsed between periods. This time she commenced to suffer with abdominal pain, which gradually decreased with cessation of the menstrual flow. A week later, one week before admission, she began to bleed again and to suffer severe abdominal pain which she described as cramps. The bleeding has become worse each day during the past week until her admission to the hospital."

Tube 55×30×25 mm., filled with blood and containing a cavity 15×10 mm. lined with a smooth wall. After a long search the embryo was found. As it was markedly dissociated and macerated, only the main features could be made out. The embryo and villi show remarkable changes. The villi are partly necrotic, fibrous, and mucoid. Some have large vesicles, making them appear much like fatty tissue. The trophoblast is extensive and invades the tube wall. The mesenchyme of the main wall

of the chorion is very thin, having dissolved itself into the coelom. Pockets in middle of the tube (?).

## No. 570.

(Dr. Hunner, Baltimore, Maryland.)

(Plate 3, fig. 1.)

Patient aged 24, married 15 months. In March 1911, after missing two periods and after heavy lifting, she had a miscarriage at about 6 weeks and curettage for secundines. She has felt well since the miscarriage in March 1911 and has had regular periods, the last period beginning December 26. On January 9 she began to bleed, only a small quantity of thick, dark blood. This has continued ever since up to the day of operation, February 9. When the period was due, January 24, there was an apparently normal bleeding for a few days. On January 13, on coming home from theater, she complained of a heavy feeling in the lower abdomen, which was almost more than she could bear. On January 15 she had a similar pain. After this she had no pain or ache until February 3, when, before getting out of bed, she was seized with a sudden pain beginning in the lower right side and continuing for 2 or 3 hours. This was relieved after coming downstairs and taking some hot coffee.

She was examined on February 8. The abdominal walls were rather tense; there was slightly more resistance and tenderness in the right pelvis. No attempt was made to outline a mass for fear of rupture. On February 9, a vaginal exploratory incision was made posterior to the cervix, and a small amount of bloody fluid was found in Douglas's pouch. The right tube was delivered and excised. The right ovary was normal. The left ovary and tube were not seen but seemed to be normal. No recent Graafian follicle was found in the right ovary. Tube, 30 mm. long, opened by Prof. Brödel, who probed out a clot, measuring 25×14×8 mm. This was hardened in corrosive acetic mixture.

A collapsed irregular ovum, embedded in a curious fibrous mass, was found. The chorion consists of a ramifying mass of tissue without blood-vessels or typical villi. There is very little trophoblast.

## No. 575.

(Dr. Hunner, Baltimore.)

(Plate 2, fig. 4, and plate 7, figs. 2, 3.)

Tube, 50×30×25 mm. The tube came unopened and was hardened in formalin. Later it was cut longitudinally and found to contain a blood clot 40×23×18 mm. Sections through the clot show a collapsed ovum with a coelom about 5 mm. in diameter. The clot is well organized and ramifying through it are fibrin bands, among which are many leucocytes. The villi show all stages of degeneration, fibrous and mucoid. Many are necrotic.

## No. 576.

(Dr. Sperry, Baltimore.)

Embryo, CR 17, AR 16 mm. Normal ovum kept in normal salt solution for 8 hours, then placed in formalin. The tube measures 60×40 mm., the cavity 30×30×25 mm. Within the wall of the tube is a layer of blood into which the ovum has implanted itself. The villi enter the clot as tufts and look quite normal. At their tips the trophoblast enters the blood clot, and along fibrin strands leucocytes radiate. Numerous atrophic villi are in the clot. The ovum as a whole peeled out easily. It is completely covered with beautiful villi.

## No. 597.

(Professor Brödel, Baltimore.)

Normal embryo, 9 mm. long. Last period about 6 weeks ago. Began bleeding about 10 days ago and stopped on day of operation. The ovum, about 20 mm. in diameter, was about to abort from the uterine tube into the abdominal cavity. Fragments of an ovum and embryo are embedded in the blood clot. The villi are numerous and branch two or three times. Apparently they are all of the same size. The embryo is normal in form, but its head is broken. It is about the stage of No. 163. Its greatest length is 9 mm. There are numerous marked changes in the walls of the chorion, and curious cells in their mesenchyme. The villi are not robust and the trophoblast is scanty. The chorion is almost entirely separated from the tube wall by a mass of blood. The embryo, which is not cut, is perfectly smooth and apparently normal. Many degenerating villi are found in the clot. At certain points the villi butt up against a mass of leucocytes and here there are degenerative changes in the trophoblast. It is often scanty and wanting, and in the latter case the leucocytes are invading the mesenchyme.

## No. 602.

(Dr. Sperry, Baltimore.)

(Plate 6, fig. 5.)

At operation the tube was found to be bleeding from its free end—an apparently beginning tubal abortion. The tube measured  $50 \times 25 \times 25$  mm. After being hardened in formalin, it was cut into blocks and a collapsed ovum, 13 mm. in diameter, was found within. Sections through this show that it is filled with blood and separated from most of the tube wall by a fresh clot. At one point the villi are blended with a fold of the tube. The collapsed ovum is a mass of degenerating villi, many leucocytes and red corpuscles, as well as a most active trophoblast, so active that it often ramifies away from the villi into the clot, giving the appearance of connective tissue. At certain points the syncytium is enormous, the nuclei often making a continuous mass. Follicular salpingitis in fimbriated end of tube.

## No. 612.

(Dr. Nichols, Baltimore.)

(Plate 6, fig. 2.)

Embryo, 8 mm. Patient, age 34, mother of a healthy 8 months old child. No miscarriages. Ruptured tubal pregnancy (left), operated upon by Dr. F. K. Nichols (St. Agnes) at 1 a. m. October 4. Sac opened at operating table, when embryo was seen. Put at once into 4 per cent formalin. Changed at 5 p. m. into 10 per cent formalin by Dr. Evans. The sac containing the embryo was sewed up at once. Two pieces were cut off and put into fresh 10 per cent formalin. October 8, 1912. The tube was cut open; it contained a beautiful white body, probably a distorted normal (?) embryo. The distended tube is about 30 mm. in diameter, with a cavity lined with a smooth membrane, 10 mm. in diameter. In it is the body of an injured embryo, the sections of which look like those of a crushed normal specimen. The section of the chorion would pass for one from a normal ovum in the tube. All of the processes seem active. The tissues of the embryo are pretty well disorganized, but stain well. I was inclined to believe them normal, but Dr. Evans thought otherwise. The tissues are probably dissociated. The embryo is injured too much to determine its form and stage of development. The villi are beautifully

developed, having a transparent mesenchyme in which are delicate blood-vessels. The trophoblast is very extensive, with large syncytial masses. It is necrotic where it comes in contact with masses of leucocytes. The trophoblast has eaten nearly through the tube wall and at some points has eroded the blood-vessels. In places the extensive trophoblast shows beautiful vacuolation.

## No. 634.

(Dr. Hetfield, Brooklyn, New York.)

Embryo, CR 19, AR 14 mm. The patient, 25 years old, missed her period 4 weeks before the ectopic pregnancy was recognized. The embryo is somewhat distorted, but to all appearances is normal. Only the embryo was sent to the laboratory.

## No. 640.

(Dr. Lowesley, New York.)

A ruptured tube ( $60 \times 40 \times 30$  mm.) and ovary were sent. Sections of the tube show a mass of villi with an extensive trophoblast. Many villi are degenerating, but many others appear to be normal. The villi have blood vessels filled with blood. Although they appear to be quite active, it is possible that the tube ruptured some time before the operation. The main chorionic wall could not be seen in any of the sections.

## No. 657.

(Dr. Elting, Albany, New York.)

(Plate 7, fig. 4.)

Normal embryo, CR, 25 mm.

On April 20, 1913, Dr. Elting writes:

"The patient is a woman aged 36, who has been married twice. She is white, has one child 17 years of age, has never had any miscarriages previously, and has always enjoyed the best of health. Her menstruation has always been regular. What she regards as her last menstruation and which she says occurred at the regular time, began 3 or 4 days before she entered the Albany Hospital, March 12, 1913. She had no idea at that time that she was pregnant. On admission to the hospital she was flowing moderately. There was some enlargement of the uterus, and a small mass on the left side was made out. No positive diagnosis of extra uterine pregnancy was made, although such a condition was considered and thought possible. Aside from the specimen, there was practically no other pathology evident at the time of operation. The patient made a very satisfactory recovery and is at the present time perfectly well."

The whole uterus with both ovaries was received in formalin. A window cut into the distended tube revealed a beautiful normal embryo. This tube measures  $90 \times 50 \times 50$  mm. The ovaries are very fibrous on the opposite side of the tubal pregnancy containing the corpus luteum. The space between the chorionic membrane and the tube wall, some 8 to 10 mm. in thickness, is composed of a clot, much of which is fresh. Through the clot ramify the villi, many of them reaching the tube wall, where they are covered with a rich and active trophoblast. This invades the tube wall as villi in its folds, showing that a firm attachment has been made. Many of the villi are degenerating, and in the older portion of the clot there is an active invasion of the leucocytes. The chorionic wall is quite thin in places, but in general it appears to be normal. Many of the villi are necrotic and are being invaded by leucocytes. In places the folds of the tube unite at their tips, forming pockets. In general they have been pretty

well eaten up by the trophoblast, and some of them lie in the clot. The ovaries are very fibrous, being filled with corpora fibrosa. No small Graafian vesicles are present in any of the sections. There is one large one, but the section is not through the ovum. The uterine mucosa seem normal. Mucosa of uterine end of tube inflamed.

No. 659.

(Dr. Vest, Johns Hopkins Hospital, Baltimore.)

The specimen, secured fresh from an operation upon a white woman by Dr. Russell, consists of a tube with the ovary. Fixed at 9<sup>h</sup> 45<sup>m</sup> a. m. in hot (40° C.) sat. aq. HgCl<sub>2</sub> and 5 per cent glacial acetic in thermostat at 37° C. for 3 hours, then room temperature for 3 hours, then 60 per cent alcohol. March 28, 70 per cent; March 29, 74 per cent. The tube measures 30×15×10 mm. and contains a clot 9 mm. in diameter. The ovary contains two large cavities, each fully 15 mm. in diameter; one communicates with the surface through a small opening and the other through a large opening. Both are lined with a narrow layer of lutein cells. The clot lies in the tube, which is almost completely lined with a layer of epithelial cells. It contains a few degenerate fibrous villi. At one point the clot is adherent to the tube wall. Here there is an extensive inflammatory reaction, there being many leucocytes at this point. What must be regarded as a few trophoblast cells are also present.

No. 667.

(Dr. Swint, Baltimore.)

Normal (?) embryo. Woman, 24 years old, first pregnancy. Hemorrhage from March 10 to date of operation, April 5. The tube was found ruptured; the ovum, 20×12 mm., was protruding from it. The whole tube measures 40×30×30 mm. The villi of the ovum are ragged and long, and upon careful inspection it is clear that the ovum has ruptured and turned inside out. The stalk of the umbilical cord is 3 mm. in diameter and 15 mm. long. Undoubtedly the embryo has escaped. Sections of the villi show they are normal in appearance, with a transparent mesenchyme containing blood vessels filled with blood. The trophoblast is quite extensive. Apparently most of it has fallen off.

No. 670.

(Dr. Smink, Baltimore.)

(Plate 2, figs. 3, 7.)

Normal embryo, CR 12.5, AR 9.5 mm. Tube very vascular, just ruptured, and the embryo in its amnion is hanging out. The implanted chorion was cut in position and found to be a beautiful specimen. The chorion seems normal; the epithelial lining of the tube is mostly intact and in many places the extensive trophoblast comes in contact with it. There are beautiful instances of the trophoblast penetrating the maternal blood-vessels and the epithelial lining of the tube, burrowing with gland-like processes into the muscle of the tube wall. The chorion and its villi appear normal, but there is much degeneration of the villi where they come in contact with a blood clot, as shown on plate 2. The trophoblast is most active after being piled up in large reticular masses. There are two large hemorrhages between the villi, but in general the intervillous spaces are filled with a clear fluid. In some of the villi there are deep invaginations of the epithelial covering, as shown in the figure. The mesenchyme of most of the villi is very rich in large flat cells which may be resting wandering cells. Pronounced follicular salpingitis.



FIG. 10.—Outline of villus, showing group of cells growing into its mesenchyme (No. 670). X 60. The part within the square is enlarged on plate 2.

No. 673.

(Dr. Wells, Hartford, Conn.)

"A day or two ago I sent you a fairly early human ovum. It was from a tubal pregnancy in the fimbriated extremity of the left Fallopian tube, just aborting through the end or possibly the side of the tube. The woman was due to menstruate on February 15, but failed to do so. On March 11 she began to flow, but without pain. This continued for 2 weeks and stopped. Early on April 5 she was seized with a sinking spell, which quickly became severe shock. I was then called. She was kept under morphine until she rallied, and on April 7 I operated on her and removed the specimen which I sent you. It was put immediately into formalin and I hope reached you in good condition. The woman is doing well."

The unruptured tube measures 16×16×16 mm. It was cut into blocks and inside was found a collapsed ovum. Sections were taken from three parts of the tube. In one of the blocks the coelom was still present with very thin walls. It must have been ruptured, as it contained blood. In fact there is an indication of the obliteration of the coelom through adhesion of the adjacent walls of the chorion. No blood-vessels are present. The villi show degeneration changes, mostly of the mucoid type. The trophoblast is often extensive, especially when it comes in contact with the tube wall, also elsewhere in the blood clot. This is a fine specimen of the destruction of the ovum in the early stages of development.

No. 685.

(Dr. Hundley, Baltimore.)

A pear-shaped tubal mole, 70×60×50 mm., containing an amniotic cavity 15×10 mm., in which are remnants of a pathological embryo about 12 mm. long.

German woman, aged 30 years, married 7 years, no children or miscarriages. Menstruated regularly every month until last month, April, when the flow was profuse and painful. May 7 noticed a slight show of blood. Since that date has been bleeding in small amounts to present time. Was taken seriously ill on the morning of May 18 with severe abdominal pain and great prostra-



tion; has dyspnoea. Diagnosis: Ruptured ectopic pregnancy. Operation, May 18. When the abdomen was opened, about a quart of free blood was found, some fresh with many dark clots of blood. In the left tube, partly extruded, was the specimen contained in the jar. The specimen was placed in 4 per cent formalin and not handled or disturbed. No history could be obtained as to the probable length of time of gestation. The bleeding of May 7 occurred 2 weeks after her last menstrual period in April."

The pear-shaped mass, which appears to be a clot peeled out from tube, was cut into blocks and microscopic sections were made, one of these being from the middle of the mass. The section passed through the embryo, the amniotic cavity, and the degenerated hemorrhagic chorion. There are but few villi scattered throughout the organized clot of which the mass is composed. It has also within it numerous fibrous strands, often accompanied by many leucocytes. Throughout the clot are scattered degenerated villi, with but little trophoblast, but occasionally with buds of syncytium. The villi show all stages of degeneration, some being necrotic, others infiltrated with leucocytes. The amniotic cavity is encircled with a thin amnion and a degenerated chorion. The embryo stains fairly well and is macerated and disintegrated and appears to be pathological.

No. 686.

(Dr. Cecil Vest, Baltimore.)

Tubal mass,  $70 \times 50 \times 40$  mm. A colored woman, 29 years of age, has menstruated regularly every 28 days since her twelfth year. Has one child 11 years old. The patient has been menstruating 3 weeks before entering the hospital. Diagnosis: pelvic abscess, peritonitis, and extrauterine pregnancy.

The specimen was taken immediately to the laboratory. It consisted of the major portion of one Fallopian tube, much distended and with large tortuous vessels on its surface, so that the appearance of a placental site was given. A normal embryo being expected, the muscular wall was carefully opened and much clotted blood was met with. The smooth opening at one end revealed the same picture, so that it was decided to open the entire mass boldly by a transverse razor cut. This procedure showed that an exceedingly large and rather firm clot was responsible for the main mass and that through it villi occurred, so that the degenerating ovum was unquestionably inclosed by the clot. The tubal mass was laid into slabs from 3 to 5 mm. thick, none of the sections revealing the embryo. The material was placed in a sat. aq. sol. of  $\text{HgCl}_2$ , to which 5 per cent glacial acetic acid was added and fixed 10 hours. While the specimen was in 60 per cent alcohol measurements of the entire mass were  $70 \times 50 \times 40$  mm. The slabs were separated for dehydration. Three sections were cut from different portions of the mass, one of which includes the outer end of the free tube, as the mass has burrowed into the tube wall, making a large pocket which communicates with the tube.

The mucosa of the free tube wall is markedly inflamed, indicating that the tube was inflamed before the ovum lodged in it. The blood clot is well organized and well adherent to the tube wall, which is inflamed and invaded with trophoblast cells. Scattered through the clot are many individual villi in process of degeneration and destruction. Some are necrotic, but most of them are surrounded with leucocytes. The trophoblast is not extensive and is degenerating, often forming masses of nuclear matter. In one of the sections is a remnant of the

collapsed ovum, fibrous and practically without any trophoblast. The ovum is detached and is disintegrating with a clot in an unruptured tube.

No. 694.

(Dr. Tobie, Portland, Maine.)

(Plate 2, fig. 1.)

Protruding clot,  $30 \times 20 \times 20$  mm. in diameter, with a cavity inside. The specimen came out with the ovary attached. This contained a number of follicles, 4 mm. in diameter, and a small corpus luteum  $6 \times 7$  mm. In the ovary there is also a second cavity ( $7 \times 15$  mm.) filled with blood and encircled by a corpus fibrosum. The tube is 40 mm. long and 10 mm. in diameter, except where the clot protrudes. The latter measures  $30 \times 20 \times 20$  mm. and contains a cavity (the coelom)  $13 \times 7 \times 7$  mm. This cavity is a closed one; it is lined throughout with mesenchyme and contains two small white nodules, 1 mm. in diameter, attached to the chorion. Sections through the chorion show the mesenchyme well developed, but the villi are degenerating. Many of them are necrotic and at some places there are large masses of nuclear matter, remnants of the syncytium. At other points the trophoblast is very active, especially where it comes in contact with the tube wall. Here it is invading the tissues and encircling the blood-vessels. Within the blood clot strands of trophoblast run in all directions after being encircled with lymphocytes.

No. 697.

(Dr. G. K. Dickinson, Jersey City, New Jersey.)

(Plate 7, fig. 5.)

Tubal mass,  $55 \times 30 \times 30$  mm. The specimen is from a German woman, 36 years old, this being the sixth pregnancy. The first two were normal; in the third an abortion took place at the fourth month; the fourth ended in a still birth; the fifth was normal. The last child was born on October 10, 1911. Menstruation began in December 1912 and continued until March 1913. The uterine hemorrhage, which relates to the present case, started on May 7, 1913. The operation for tubal pregnancy was on June 1, 1913, when the left tube was removed. There was no history suggestive of any pathological process in the uterus; no history whatever of venereal disease. The specimen was hardened in 2 per cent formalin and sent to the laboratory in this solution; when it came to the laboratory it was found to consist of a rigid tube, the outer half of which measured  $55 \times 30 \times 30$  mm. It had been cut open by the operator before the specimen was fixed. The incision made in the tube passed through the mass of a clot which was about 20 mm. in diameter. The clot appeared to be well fixed, and within was a cavity lined with membrane, folded in places, which probably represented the amnion. Within this cavity was soft granular tube about 3 mm., probably the embryo. The specimen was cut through the outer third and the inner third of the tubal mass. The second cut passed through the embryonic "remnant." Sections through this show what appears to be a degenerate embryonic head, much resembling the lymph follicle, in which there is a faint outline of the dissociated central nervous system. The inner mass is surrounded with a delicate membrane covered with a single layer of flattened epithelium. The cavity containing the embryo is lined throughout with a degenerated chorion, to which the amnion is attached more or less freely. The chorionic wall and villi show marked fibrous, as well as mucoid, degeneration. Many



of them are necrotic. At no point in the sections does the chorion come in contact with the tube wall, but is separated by the clot, which is ramified by many bands of fibrin. This clot is markedly free from lymphocytes. Some of the villi are covered with an active syncytium, which extends into the clot, and forms pronounced trophoblast; in places there are also individual cells. The mesoderm and some of the villi are also being invaded by the syncytium. The tube is hypertrophied, but at no point in the sections does it show an invasion of trophoblast cells; it is, however, infiltrated with leucocytes. Follicular salpingitis and outpocketings are present.

## No. 706.

(Dr. H. M. Torrey, Detroit, Michigan.)

Ruptured tubal pregnancy,  $55 \times 15 \times 15$ , containing a normal embryo 6.5 mm. long. American, aged 31 years. Contracted pelvis (anterior superior spine 20 cm., crests 23 cm., trochanter 31 cm., external conjugate diameter 16 cm.). This is the fourth pregnancy. Abortion by surgeon five years ago because of contracted pelvis, birth at 6 months two years ago. Patient seen on June 8, 1913. Periods have been regular, but last was missed 3 weeks ago. On June 2 had labor pains and a bloody discharge, passed clots, but the temperature and pulse were normal. At the time of examination the uterus was found enlarged and very tender, and there was a mass to its left. There was no evidence of infection. Venereal disease was positively denied. Diagnosis: Left tubal pregnancy.

The patient was taken suddenly with intense pain in the left lower abdomen on June 9. Pulse of collapse, 120; temperature 97.6. Improvement was gradual. Operation on June 10. The abdominal cavity contained many large clots, but no fresh hemorrhage. The left tube contained a fetus and membranes, which had ruptured downward. Both ovaries appeared to be normal. No salpingitis, no pelvic inflammatory disease. The uterus was enlarged but appeared to be normal. When the specimen came it contained a clot protruding from the ruptured tube. Within this there was a cavity, about 7 mm. in diameter, just large enough to hold an embryo. We were probably dealing with an unruptured specimen, as only the clot protruded from the ruptured tube wall. No description of the embryo was given. Sections of the clot containing the chorion show that the chorionic wall is fibrous, with few long, slender villi extending from it in various directions through the blood clot. Some of them contain blood-vessels and the blood-vessels are filled with blood like the main wall of the chorion. The blood clot is not infiltrated to any extent with leucocytes nor with trophoblast cells; there are, however, numerous isolated cells in the probable neighborhood of the villi and occasionally they run together and form a syncytium. The lymphocytes or leucocytes seem to accumulate more in the neighborhood of the villi. The ovary contains numerous corpora fibrosa and also a large cavity which is filled with clear fluid and is surrounded by small patches of lutein cells. This cavity communicates with the protrusions upon the surface of the ovary, but do not contain any fluid.

## No. 720.

(Dr. J. M. Hundley, Baltimore.)

(Plate 8, figs. 1, 5.)

Unruptured right tube,  $90 \times 30$  mm. This specimen consists of an unopened tube which has a smooth surface and is considerably swollen in its middle third. The straightened-out tube measures 90 mm. and the middle

distended third 30 mm. The diameter of the inner third is 5 mm., the middle third 14 mm., and the outer third 9 mm. The patient, aged 40 years, has had seven live-born children and six miscarriages. The youngest child is 4 years old. She has had two miscarriages since his birth. The menstrual periods have recurred every 3 weeks and are more profuse than formerly. The last menstrual period began on May 14. In June she should have menstruated 3 weeks after that date (June 4), but did not flow until June 29. On that date she was taken with violent pains in the abdomen and then with uterine hemorrhages. She bled profusely for 2 hours and then the bleeding ceased, but returned on July 3. She was operated on by Dr. Hundley July 4. She was brought to the University Hospital to be operated on for appendicitis, but a diagnosis of a possible tubal pregnancy was made before operation. The abdomen contained about a pint of old blood clot. The pregnancy had occurred in the right tube.

The specimen was received at the laboratory in formalin July 11, 1913, in which it was carefully preserved. A drawing of it, natural size, is shown in the illustration. It was cut into blocks, sections being taken from four portions of the tube. The smooth tube was found filled with a blood clot, apparently organized, but not adherent to the tube wall. At certain points the collapsed ovum could be made out. Sections through the tube near the uterine end of the clot show that the mucous membrane is in folds which are not in apposition with a small extension of the clot into this region. This portion of the clot is granular, apparently being composed of degenerated red blood corpuscles. The two sections through the clot (b and c in the figure) show a well-organized clot with fibrin bands extending through it, degenerate villi, and masses of white blood-cells. The trophoblast is generally wanting, except where the villi come in contact with the tube wall, where it is quite active. At these points the epithelium of the tube wall is wanting and the trophoblast is invading the muscle wall, which shows an active inflammatory reaction. The villi show all stages of mucoid degeneration and at certain points some are necrotic. The section through the fimbriated end of the tube shows that its folds are intact, but bound together more or less by a fluid exudate. There is no inflammation here.

## No. 726.

(Dr. Wright, Baltimore.)

Tubal mass, unruptured,  $60 \times 40 \times 30$  mm. The specimen came from a white woman, 30 years of age, who had been married two years, and had had an abortion at 3 months, and one full-term child was born in February, 1913. She menstruated in March and again from April 25 to 29. Ten days later began to flow, and continued to do so up to the day of operation. At first the flow was bright red, later it was scanty and dark colored. She denies having had venereal disease. Operation for ectopic pregnancy July 15, 1913. Right tube and ovary removed. The specimen came to the laboratory in formalin. The tube and ovary together form an irregular mass  $60 \times 40 \times 30$  mm. The proximate end of the tube is small, and the distal fimbriated end can not be found. Towards the distal end there is a hemorrhagic mass,  $20 \times 35$  mm., which had been cut into after the specimen was fixed. Sections were cut through the ovary and through three portions of the tube. The tube on the central side of the pregnancy has very extensive foldings, the section of the mucosa forming a network with numerous processes ending blindly in the mesh. The spaces are filled with blood

serum and pus, indicating that there had been an extensive salpingitis with pocket formation of the mucosa. The fimbriated end shows a similar inflammation, but no pocket formation. The main mass consists mostly of a clot, partly organized, throughout which is seen much nuclear material representing degenerated syncytium, and a few villi on the left, most of which show a mucoid degeneration of their mesenchyme. The tube wall is somewhat inflamed; its epithelial lining is for the most part wanting. There is no trophoblast in any of the sections.

## No. 728.

(Dr. Branham, Baltimore.)

Tubal mass, 60×40×30 mm.

Ruptured collapsed tubal wall with several blood clots, some of which are about 5 cm. in diameter. Embryo 15 mm. (?) The specimen was brought to the laboratory fresh and put in a finger bowl. Among the floating fragments were found the tail and legs of an apparently normal embryo about 15 mm. long. All were preserved in formalin.

The specimen came from a white American woman, 30 years of age, this being her second pregnancy, the first having ended at full term. Her last menstrual period began May 8 and continued to May 15. On May 29 she began to bleed. When she consulted Dr. Branham, he found that the uterus was markedly enlarged, and on July 17 she was operated on for tubal pregnancy. At the time of the operation, it was found that the left tube had ruptured near its distal end. No history of venereal disease. The specimen consists of two large blood clots, a collapsed tube, which has been opened throughout its length, and one ovary, to which a piece of the tube is attached. This piece is apparently the fimbriated end. Within the ovary is a cavity filled with gelatinous fluid, but there is no hemorrhage. The lower part of the embryo which accompanies this specimen appears to be normal, as the legs are well formed.

Sections were made through the middle of the cavity which contains the embryo and through the large vesicle of the ovary. The section through the thick wall of the ovum shows that the chorion is well infiltrated with leucocytes, and the villi are matted together with bloody syncytium and an organized clot. The epithelium covering many of the villi is necrotic, and at these points are large accumulations of leucocytes, showing that there was a very active inflammatory process before the tube was ruptured. At some points on the surface of the clot there is considerable activity of the trophoblasts. Elsewhere the cores of the villi show various kinds of degeneration, both fibroid and mucoid. Sections through the vesicle of the ovary show that it is completely surrounded with a well-formed corpus luteum. Outpocketings are present in middle portion of the tube.

## No. 729.

(Dr. H. G. Sloan, Cleveland, Ohio.)

(Plate 10, figs. 3, 4, 5.)

Ruptured tube 20×10 mm., embryo 8 mm. From a white woman, aged 25, who was married in 1907. She has had four pregnancies. In the first two abortion took place at 6 weeks; the third ended in the birth of a healthy child at term, and the fourth is this tubal pregnancy. The last period was from June 22 to 25, 1913. The operation for tubal pregnancy, following rupture of the tube, was performed on July 16. At the time of the operation it was found that the right tube had ruptured

at a point 1 cm. from the uterus, and the fimbriated end of the left tube was inverted and closed by adhesions. The patient acquired syphilis in 1905, and she had a doubtful history of gonorrhea. She came from a large family.

The specimen, which was fixed in formalin, was received at the laboratory on July 19, 1913, and immediately placed in fresh 10 per cent formalin. It consisted of a small piece of tube, which is about 20 mm. long and 10 mm. in diameter. It is distended with a blood clot and on one side a rupture has occurred which has allowed the ovum to protrude. The ovum is covered with so extensive a mass of villi that it seems to be composed almost exclusively of them. The entire embryonic mass is 8 mm. long; the individual villi are 4 mm. long and branch two or three times. Sections were cut in celloidin through the uterine end of the tube and through the middle of the rupture. The ovum was embedded in paraffin and cut into serial sections. The general appearance of the specimen and some of the villi are shown in the figure. The sections through the uterine end of the tube show that the mucosa is thrown into folds, but there is no indication that they are adherent. At one point there is a marked diverticulum of the epithelial layer of the mucosa, producing a distinct glandular appearance. Sections through the point of rupture are interesting. They show that the trophoblast is eating into the tube with great force, and at the point of rupture it has naturally destroyed the whole muscular coat. In the vicinity the tube wall is hemorrhagic and inflamed. On the broad-ligament side the process is extremely active. The syncytium is active and vascular and is being invaded by tissues which are destroying the sides of the large arteries. The hemorrhages thus produced are barred off by the extended wall from which the trophoblast has protruded. There is very little hemorrhage between the villi, and at points where they are engulfed with blood they are necrotic and invaded by the leucocytes.

The ovum is covered with irregular villi, which indicates that it is pathological. The serial sections show that the villi are somewhat fibrous, but most of them contain well-defined blood-vessels, indicating that a recent but normal embryo must have been present. The wall of the chorion is torn, thickened, and collapsed, and contains a small amount of free blood. The coelom is well filled with many folds of the amnion, and through the opening in the chorion the umbilical cord protrudes. The structure of the amnion appears to be quite normal, but the chorion and cord are somewhat fibrous. Toward the free end of the cord it is easy to make out two arteries, while at its tip there is an irregular ragged mass of cells, indicating that the cord has been torn from the body of the embryo. The examination of the specimen indicates that we are dealing with an ovum which contained a normal embryo at the time of the rupture, and that shortly before the operation the embryo escaped from the ovum; however, enough time must have elapsed to allow for the secondary changes, as indicated by the fibrous end of the cord and the irregular form of the piece of the embryo which remains attached to the cord. Sufficient time elapsed to allow the injured cord to fall apart. The uterine end of the tube consists of multiple lumina.

## No. 734.

(Dr. Vest, Baltimore.)

(Plate 9, figs. 1, 2.)

Unruptured tube, 50×25×25 mm. The specimen is from a colored woman, 33 years old. She has had two full-term children, but no miscarriages. No evidence of

venereal disease. The last period began July 15, 1913, and the previous one 4 weeks earlier. Pain came on 5 weeks before the operation, which took place on July 26. A few old adhesions were found; otherwise, with the exception of the distended tube, everything was normal. The right tube was removed. The unruptured specimen was brought to the laboratory and fixed in formalin. The uterine end is apparently normal and the clot protrudes from the fimbriated end. Sections were cut from four portions of the tube. Those through the uterine end show that the muscle wall is hypertrophied and the tube lumina multiply, about 20 being present in a single section. Some of the lumina end in blind pockets. The fimbriated end appears edematous, possibly a post-operative change, as the specimen is covered with a fungus. However, the blood-vessels are gorged with blood. The two sections through the clot show that it is well organized and contains a collapsed ovum and swollen, degenerated, and necrotic villi. The trophoblast is absent; the clot is not adherent to the tube wall, but the latter shows some inflammatory reaction.

## No. 741.

(Dr. Watkins, Baltimore.)

(Plate 8, figs. 2, 3, 4.)

Pus tube, 30 mm. in diameter, on the left side, and unruptured tubal pregnancy,  $70 \times 50 \times 40$ , on the right side.

The specimen is from a white woman, 28 years old, married  $2\frac{1}{2}$  years ago. No previous pregnancies. No apparent venereal disease. Low grade of chronic pelvic inflammation, possibly gonorrheal. Last normal period March 16, 1913. Regular and normal till then. Missed three periods and then bled for 10 days. Operation, August 14, 1913. Specimen placed in 10 per cent formalin at

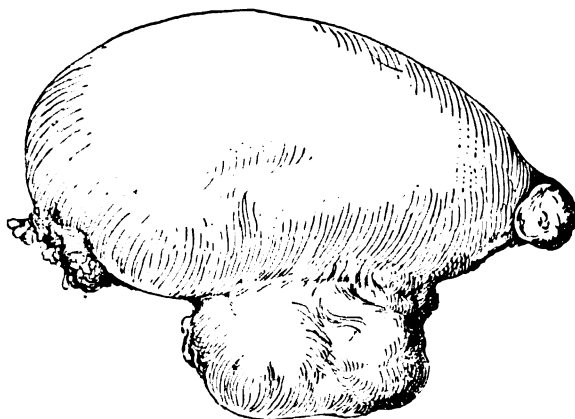


FIG. 11.—Outline of tube with ovary attached (No. 741).

4 p. m. and slabs cut with a Gillette blade at 6<sup>15</sup> p. m. Fresh formalin. The blade laid bare the chorion surrounded by a large blood clot. The pus tube, which was not opened at this time, is pear-shaped, with the stem kinked upon the body. The larger part, that is, the distal end, measures 30 mm. in diameter and has a very thin wall which is about to rupture. It extends up to the inner opening of the tube. When opened, it is found to be filled with a watery fluid containing some flakes. The middle third of the specimen is also distended, being 15 mm. in diameter, while the inner or uterine end seems to be normal.

The fimbriated end is closed completely. The unruptured tube is a large, solid mass  $70 \times 50 \times 45$  mm., to which an ovary is attached. Sections of the specimen show that it is for the most part filled with blood, the chorion being in the center, triangular in shape, and lined with a smooth membrane. Its greatest diameter is 10 mm. The pus tube on the left side shows marked folding of the mucous membrane. At its uterine end some of the folds resemble the villi of the intestine. There are only a few folds in the tube where it is moderately distended, and very few where it is distended to the maximum. The wall shows no active inflammation. The right tube contains the pregnancy. The uterine end of the muscular wall of this tube is markedly thickened, and the mucosa is likewise thrown into folds; possibly there are several lumina instead of one. The fimbria are congested. The distended tube wall was cut through at the site of the ovum, which in section is 5 by 15 mm. The ovum is entirely detached from the tube wall. The villi are atrophic and necrotic, forming delicate threads which radiate from the ovum and are extended by means of fibrous bands to the wall of the tube. The clot is partly organized and partly fresh and the tube wall is more or less infiltrated with leucocytes, which in some places form abscesses. The cavity of the ovum is crossed by strands of mesenchyme, and on one side there is a small nodule which possibly is the embryo.

## No. 754.

(Dr. Kolb, Baltimore.)

(Plate 3, fig. 2, and plate 9, fig. 3.)

Ruptured tube,  $70 \times 25 \times 15$  mm. Ovum  $1 \times 2$  mm.

"Jewess, 27 years old, married 6 years; one previous pregnancy, which ended in a normal birth 5 years ago. Last period August 26 to 29, 1913. Operation for ruptured tubal pregnancy, August 30, 1913. No history of venereal disease. The uterus was found slightly enlarged, ovaries and left tube normal in appearance. Right tube and ovary removed."

The specimen consists of a tube presenting a small rupture and a clot protruding from the fimbriated end. It was cut into blocks and sections were taken from three parts of the tube. Those from the uterine end show that it contains a single small lumen. The other sections show a clot with the remnant of the ovum, the clot implicating the wall of the tube more or less in an inflammatory process. Sections show that the muscle is markedly infiltrated with round cells. The blood-vessels of the fimbria are engorged with blood and the folds are matted together with an exudate. Within the tube wall and on its peritoneal surface are two circumscribed solid masses of epithelial cells. Near the fimbriated end of the tube the sections struck the ovum, which measures about  $1 \times 2$  mm. It lies detached upon the folds of the tube and some of the villi protrude into an adjacent clot. The villi show all stages of degeneration and necrosis, and the chorionic membrane is almost destroyed. At some points it is represented only by necrotic hyaline syncytium. The coelom is filled with a mottled magma. There are no blood vessels in the chorion. At no point has the chorion remained attached to the tube wall. Repeated examinations of the blocks and the sections make it impossible to find the point of rupture in the tube. As the tube wall is much infiltrated and as the clot is protruding through the opening of the fimbriated end, it may be that we are not dealing with a case of rupture. In any case the rupture, if any, must have been very small.

## No. 762

(Dr. Leonard, Baltimore.)

Unruptured tubal mass,  $65 \times 45 \times 35$  mm. From a white woman, who has been married 6 years. Soon after marriage she missed four periods and then aborted. The last period began on August 14, 1913, the previous one having occurred on July 3. After the last period there were bleeding and pain until the operation, which took place September 24. The uterus was found somewhat enlarged and covered with adhesions. The left tube and the ovary were found plastered to the side of the uterus and covered with omentum which was densely adherent. There were no signs of venereal disease. The tubal mass consists of a convoluted tube, 20 mm. in diameter, reminding one much of a dog's intestine. The fimbriae are matted together and the ovary is attached. Uterine scrapings were also secured. These were fixed in corrosive-acetic mixture and cut into serial sections. The tubal mass was cut in three places, as the figure shows. Sections of the mass show that the tube is filled with blood and at certain points it appears as if the ovum were present. Microscopic examination shows that the clot is well organized and much infiltrated with leucocytes. A few villi are present and some of them have been nearly destroyed by the leucocytes. Small patches of syncytium are occasionally seen, but are not connected with the villi. The villi are swollen throughout the specimen, showing that the remnants of the ovum have been scattered far and wide. The uterine scrapings are composed of small clots of mucosa and blood. They do not show inflammatory reaction.



FIG. 12.—Outline of the matted tube of No. 762, the mass of which is composed of very large vessels interlacing the distended tube wall.  $\times \frac{1}{2}$ .

## No. 765a.

(Dr. Harvie, Troy, New York.)

Unruptured tube, 75 mm. long and 30 mm. in diameter. It is filled throughout with blood and is apparently ready to rupture. On one side there is attached to it a small white body about 20 mm. long, 15 mm. wide, and 5 mm. thick; probably the ovary.

The specimen was removed at an operation from a Jewess, aged 40 years, this being her eighth pregnancy. She has had two miscarriages and several normal labors since her last miscarriage. There are six healthy children, all living. The last menstruation occurred on July 23, 1913. She began to flow again August 26 and continued to do so until the operation, September 29. Sections were taken through the middle of the tube which passed through a stellate-shaped cavity, about 5 mm. in diameter. This cavity is lined with a membrane, the chorion, from which there radiate a few long fibrous villi. Between the cavity—which is the cavity of the ovum—and the tube wall is a well-organized clot. At the periphery of the clot is an extensive infiltration with leucocytes. The chorion and radiating villi are mostly necrotic. However, the few cells remaining, which cover the main wall of the chorion, take the hematoxylin stain. It appears as if the detachment of the ovum had caused its strangulation and death. A secondary inflammation on the periphery of the clot involves the tube, but does not reach the ovum. The section through the ovary shows numerous corpora fibrosa and very few Graafian vesicles, all of which are unruptured. One large unruptured follicle has a layer of lutein cells, forming a zone around the granulosa cells.

## No. 766.

(Dr. Haskell, Bridgeport, Connecticut.)

Unruptured,  $55 \times 45 \times 40$  mm. Embryo 10 mm.

"The specimen comes from a patient 27 years old, who has been married 7 years. She has never been pregnant and is very anxious to have children. No measures to prevent conception have ever been taken. She has had pain and tenderness in the right lower quadrangle for two years, but recovered without operation. Dilatation and curettage was performed 6 months ago, when a small polypus was removed from the minor os. On September 22, 1913, she was taken suddenly with pain in the lower abdomen; the pain was not definitely located. She had numerous fainting spells followed by collapse. Since then she has had more or less pain and marked tenderness in the lower left side, but little abdominal distention. There were intermittent bloody discharges from the uterus. The last period occurred early in August, but she missed the one due in September, and, therefore, believed herself pregnant. Operation, October 2, 1913."

The specimen resembles a walnut; it is hard and hemorrhagic, and measures  $55 \times 45 \times 40$  mm. It has a very thin wall, which appears to be a well-developed chorion infiltrated with blood. Within is a cavity, 15 mm. in diameter, partly filled with reticular magma and partly with free blood clot, as well as a degenerated embryo and an ovary. The specimen is attached to the ovary. The embryo is granular and degenerating. Sections were made through the ovary and through the middle of the tube, striking the embryo. The section is circular in form, measuring 42 mm. in diameter. In the middle is a cavity, 15 mm. in diameter. The thickened tube wall consists of a mass of organized clot which has destroyed the ovum (?). This clot is permeated with villi in all stages of degeneration, syncytium, and masses of leucocytes. Many of the villi are necrotic. The trophoblast upon the chorionic membrane is quite active, while that at the tips of the villi is scanty or necrotic. The chorionic membrane is clear and quite normal in appearance and lined with a thin amnion. The embryo is completely dissociated; individual structures can not be made out. Many of the villi are being invaded by leucocytes, which often appear in great hordes.

## No. 772.

(Dr. Lowsley, New York.)

Unruptured tubal mass,  $30 \times 20 \times 15$  mm.

The last period began June 23, 1913, and the bleeding continued for 15 days. Operation, July 9. The specimen, preserved in formalin, came with the ovary attached. The tube is kinked upon itself and shows a distention in its middle portion, which is filled with a clot of blood, 12 mm. in diameter. There is a second specimen in the bottle which appears to be a portion of the other ovary with a corpus hemorrhagicum in it. Sections were made through both ovaries, through the middle of the enlargement and the distal and proximal ends of the tube. The uterine end of the tube appears to be normal; the lumen is well defined and folds of the mucosa are covered with a beautiful epithelium. The fimbriated end also appears to be normal. Between the folds there is some blood and possibly a little exudate. The clot within is well organized, is fully detached from the tube wall, and shows strands of

fibrin running through it. Along these strands are many leucocytes and also rows of trophoblast cells. The scattered villi show all stages of degeneration, but near the surface of the clot a small group of these is covered with an active mass of trophoblasts. Here there is a pronounced syncytium. The clot as a whole peels out of the tube wall very readily, showing that the chorion did not attach itself to any portion of its wall.



FIG. 13.—Outline of tube with ovary attached (No. 772).  $\times \frac{1}{2}$ .

## No. 773.

(Dr. Lowsley, New York.)

Unruptured tube,  $55 \times 20 \times 15$  mm. The specimen, without any history, was given me, hardened in formalin. It is spiral-shaped, as the figure shows. Sections were cut from parts of the tube, which were found filled with an organized clot. At some points the strands of "fibrin" seemed to represent a disintegrating ovum. The uterine end of the tube seems quite normal; the fimbriated end is somewhat hyperemic. The intermediate portion of the



FIG. 14.—Outline of kinked tube before it was opened (No. 773).  $\times \frac{1}{2}$ .

tube contains a well-organized clot, which is reticulated; in the meshes are fresh hemorrhages. In the middle of each area of fresh blood there is usually a villus, indicating that the fresh blood entered the clot along the lines of the villi. There is quite an extensive leucocytic infiltration around the clot and along the fibrin bands. The clot is attached to the tube wall at one point only in a pocket; the epithelial lining and folds are intact.

## No. 775.

(Dr. Lowsley, New York.)

(Plate 10, fig. 1.)

Unruptured tubal pregnancy,  $70 \times 40 \times 35$  mm. The tube is filled with an organized clot, within which lies a collapsed ovum radiating from the center to the periphery of the clot. The walls of the chorion have collapsed to form a plexiform structure with occasional cavities in the chorion. It is entirely necrotic. On the periphery is a zone of leucocytes. On one side the tube wall is intact; it is markedly infiltrated and gradually merges on the other side with the clot.

## No. 777.

(Dr. Tobie, Portland, Maine.)

Unruptured tubal pregnancy,  $75 \times 55 \times 55$  mm. From an American woman, 28 years of age, married twice within five years. She was never pregnant before, although her first husband was the father of children by another wife. The first husband probably had gonorrhea. The patient comes from a fertile family. She has been treated for tenderness over the left ovary, probably a pyosalpinx. Her last period was from July 4 to 8, the flow continuing until the time of the operation for tubal pregnancy, September 30, 1913. The left tube and ovary were found matted together with a large amount of blood. This tube was removed.

Upon examination of the specimen a very large oval, unruptured tubal pregnancy is found, which is quite vascular. The dimensions are  $75 \times 55 \times 55$  mm. It is completely filled with large, partly organized blood clots, in the center of which is a stellate cavity about 5 mm. in diameter, which probably represents the cavity of the ovum. The clot is mottled with fresh masses of blood, showing that the hemorrhage in the tube has been continuous. The clot is not attached to the tube wall, which is lined with folds more or less matted together. The tube is inflamed and is encircled by a thick inflammatory deposit. Within the clot are a few necrotic villi, but very few signs of nuclear dust. Nor have the leucocytes permeated the clot to any marked extent. A few detached tubal folds in the clot are surrounded with leucocytes.

## No. 784.

(Dr. Iseman, Chicago.)

Ruptured tubal mass,  $75 \times 35 \times 35$  mm., dumbbell-shaped. Pathological embryo, 5 mm. long. The specimen is from an American woman, 41 years old, who was married 14 weeks before the operation. She had not been pregnant before. No history of venereal disease. She had suffered from chronic catarrhal and interstitial inflammation of both tubes and chronic pelvic peritonitis. She came from a very fertile family. The last period began August 2 and continued until August 6, 1913. On September 2 the patient began flowing in the usual way, but the flow did not stop at the end of 4 days, continuing until the time of the operation, October 2. On September 20 the patient had severe pains and all of the symptoms of rupture of the tube. At the time of the operation the uterus was found to be somewhat enlarged and soft; the cervix was very soft. There was no infection.

The entire mass consists of a tube apparently ruptured, which has also been cut into. One of the enlargements contains a cavity from which a very delicate membrane protrudes. At the bottom of this cavity is an elongated embryo, showing arm and leg buds. The straightened embryo measures 8 mm. On account of its smoothness, the shape of the head and extremities, it may be normal;

the fact, however, that the amniotic sac measures 15 mm. in diameter speaks against it. Upon further study it appears as though the specimen had not been ruptured, but opened by the operator. Also, in moving the embryo around slowly in formalin, it naturally rolls upon itself, taking a normal form, the greatest length of which is 5 mm.

Sections through the tube wall show that the chorionic membrane, villi, and tube form a continuous mass, being tied together by an inflammatory hemorrhagic mass. There are some degenerate villi attached to the peritoneal side of the wall, showing that the tube had ruptured before the operation. Many of the villi are well formed, being covered also with an active trophoblast. This often extends away from the villi in long streams, which are lost in the blood clot or which are extended to the peritoneal side of the tube by means of fibrin bands. Much of the syncytium is necrotic, some is vacuolated, and some shows nuclear fragmentation. The mesenchyme of the villi shows a variety of forms of degeneration and some of them contain blood-vessels. The chorionic wall is quite thin and apparently normal. Serial sections of the embryo show that it is markedly deformed, the tissues are dissociated, and the individual organs can not be outlined.

## No. 787.

(Dr. Sanderson, Canandaigua, New York.)

Unruptured tube, 40×11×11 mm. From an American woman, 28 years old. She had been married 7 years and this is her first pregnancy. Last period from September 15 to 20; operation, October 26, 1913. Periods had been normal and regular. No history of venereal diseases. At the operation it was found that the uterus was small, but in normal position. The ovaries and other tubes were apparently normal. There is a tendency towards sterility in the family.

The specimen consists of 4 blood clots, the largest of which is 2 cm. in diameter, and an unruptured tube 40 mm. long and 11 mm. in diameter. The distention is near the fimbriated end. A number of blood clots have been formed from the blood which has leaked into the peritoneal cavity. Sections were taken from the tube in three places. At the uterine end the folds were matted together, almost obliterating the tube lumen. A number of gland-like ducts extend into the muscle wall. At the fimbriated end a similar condition exists. In the center of the tube the folds of the mucosa form a dense plexus all around the tube and the clot in the center is well organized. There are numerous fresh hemorrhages. At one point is a small group of fibrous villi between the clot and the mucosa. In the neighborhood of these the mucosa is infiltrated with fresh blood, showing the source of the hemorrhage. In some of the sections is a group of peculiar cells, which line part of the tube wall. They may be trophoblast cells.



FIG. 15.—Outline of small tube containing a remnant of an embryo (No. 787).  $\times \frac{1}{2}$ .

## No. 790.

(Dr. Darling, Milwaukee.)

Tubal mass, 75×45×40 mm. Embryo, 20 mm. long.

"The specimen was removed by Dr. F. Munkivity and myself and submitted to Dr. Bunting for diagnosis, as it appeared to be one of true implantation of the placenta. At the lower angle of the opening incision in the specimen the fetal cord was attached to the cavity wall or rather to the placenta, which in turn was here implanted. To us the



FIG. 16.—Tubal pregnancy which has broken into the broad ligament (No. 790).  $\times \frac{1}{2}$ .

tissue beneath this appeared to be ovarian. When fresh the yellow lutein tissue at this point was very distinct."

Patient, a German American, 28 years old, this being her first pregnancy. Married in 1906. Last period January 20-26, 1913; missed February 20; nausea, with abnormal appetite. Operation, April 21. In 1906, the year of marriage, the patient bled every 2 weeks for 2 or 3 days; no pain. A surgeon removed two cervical polypi. Bleeding ceased for a year, when the same thing again occurred. Polypi were then removed. In 1909 polypi were again removed. No other previous history bearing on condition. In 1913 intermittent bleeding from February 23 until April 21. Pain in side April 20. Uterus enlarged to size of two months' pregnancy. No venereal disease discoverable, nor is there a history of it; no discharge. The husband denies gonorrhea. Left adnexa normal. Very little blood in abdominal cavity. Tube unruptured, but distention threatened. Peritoneum velvety and slightly torn by distention.

This specimen is said to be an ovarian pregnancy. The entire mass measures 75×45×40 mm. At one end the specimen has been opened and contains a cavity, 28 mm. in diameter, which is lined with a smooth membrane and contains a distorted and much injured embryo, apparently normal in form, but adherent at the back of its neck to the wall of the chorion. This anomaly is due to a stitch. The adhesion is composed of delicate fibers. The specimen was cut into slabs, 4 mm. in thickness, and was found to be the hemorrhagic wall of the ovum, that is, the chorion lined with a shell of tough tissue, which may or may not be the ovarian tissue. This is to be determined after the sections have been cut.

Sections were cut from four of the blocks, as indicated in figure 16. Those through the uterine end of the tube show a lumen, 2 mm. in diameter. The mucosa is hypertrophied and the folds are matted together. The section through the enlargement, as indicated in the figure, shows that it contains a cavity which communicates with the cavity containing the ovum and a cross-section of the tube which has a lumen, 8 mm. in diameter. It has very large



folds, which are hyperemic and more or less matted together. The cavity is lined with degenerating villi. The two other sections are through the chorion and its wall. At no point is there any ovarian tissue around this cavity. In one section the tube communicates with the cavity containing the ovum. It is clear that we are here dealing with a tubal pregnancy, which has ruptured into this broad ligament, and not with an ovarian pregnancy.

The embryo is normal in form, but the chorion is markedly changed in appearance. The chorionic membrane is quite normal in appearance, but the villi are fibrous and degenerating. Many of them are necrotic and covered with masses of necrotic syncytium. Some of them contain blood-vessels from the embryo, showing that an embryonic circulation could still take place. What is especially remarkable is the great activity of the trophoblast, which is invading everything—necrotic syncytium masses, mesoderm, blood clot, and the adjacent maternal tissue. In some places the scattered trophoblast cells in the maternal tissue give the exact appearance of cancer. In fact, the cells have invaded the venous sinuses and in some instances a whole villus may be seen in them. There is much inflammatory reaction all through the specimen. In some instances, the leucocytes are invading the necrotic villi. A small degenerated ovary lies upon the specimen, as shown in the figure. Sections through it contain no follicle, but numerous corpora fibrosa. As the cavity under this small ovary communicates freely with the tube, the interpretation of the specimen, namely, that a tubal pregnancy has ruptured into the broad ligament, is the only tenable one.

No. 794.

(Dr. T. Cullen, Baltimore.)

Unruptured tube, 60×20×20 mm.

Patient, white, aged 29, admitted to the Johns Hopkins Hospital November 6, 1913. Operation: Right salpingostomy; appendectomy; D. & C. on November 8, 1913. Diagnosis: Extra-uterine pregnancy and chronic pelvi-appendicitis. Complaint: pain in abdomen and bleeding. Catamenia began at 15; regular from onset every 28 days, duration about a week. Flow not excessive. Has never had any leucorrhea. Last menstruation 7 weeks ago. Preceding one 11 weeks ago. Married 7 years. Two children, aged 5 and 6 years respectively; no miscarriages.

Present illness: Missed last regular period 3 weeks ago. Following this she had considerable pain in the abdomen, gradually becoming more and more severe. Ten days ago she had nausea and vomiting, with acute attacks of cramps in the lower abdomen, more severe on the right side. For a few days preceding this pain she had a faint trace of bloody discharge from the vagina. The pain 10 days ago was so severe that morphine was required. This pain was of a labor-like character. Two days after this acute attack she began to pass large clots of blood and thick mucus and continued to pass these clots of blood for 2 or 3 days. She had very little pain at this time, but very marked "soreness" in lower abdomen. She has continued to have a constant flow since that time, which has resembled in every way a regular period. For the past week she has had no sharp pain, but extreme tenderness. She is a fairly well nourished woman.

Note on admission: Considerable tenderness over lower abdomen; no muscle spasm and no mass felt; outlet not relaxed; some bloody discharge; cervix small and somewhat softened; uterus small and in anteversion; some induration in both fornices; considerable tenderness. No mass is felt. Convalescence was prolonged by a phlebitis in the right leg.

The specimen was sent to the laboratory fresh, being the right tube from a woman 29 years old. It was fixed in formalin. Tube evenly distended in outer half and, upon section, is found filled with blood, a portion of which reaches almost to the fimbriae. This is well illustrated in the figures. Sections show that the clot is not adherent to the tube wall. It distends the tube lumen near the uterus. Here the mucous membrane is thrown into single folds. Near the fimbria the tube also shows normal folding of the mucous membrane, but the clot is streaked with fibrin bands. At no part is it adherent to the tube wall. The central end of the distention, like the uterine end of the tube, contains blood.

The clot was cut into small blocks and in its middle was found a small white nodule, about 5 mm. in diameter, composed of an old clot much infiltrated with leucocytes; also many thick fibrin bands; no villi. This old clot is surrounded with blood in circular layers marked by semi-circles of fibrin strands. Occasionally there are small groups of cells which may represent syncytium; otherwise there is no sign of the chorion. The clot was carefully cut in small blocks and each examined under a lens, but no suspicious places could be found. However, since in a specimen like this only a villus or two are sometimes found, this is probably one in which the ovum has been entirely destroyed.



Fig. 17.—Sketch of distended tube, showing a kink between the pregnancy and the uterus (No. 794).  $\times \frac{1}{2}$ .

No. 804.

(Dr. Thomas S. Cullen, Baltimore.)

Pathological, embryonic mass. Unruptured tube with fimbriated end attached, measuring 50×40×40 mm., came from an unmarried negress, 20 years of age. There had been one previous pregnancy, 3 years before, but no miscarriages. The last menstrual period had begun November 25; the previous one November 4; the operation was performed December 6. Except for severe pain in the iliac fossa for one month before operation, there had been no symptom of tubal pregnancy. The patient had had a puerperal infection and pelvic peritonitis after the birth of her child, 3 years before. At the time of the operation the ovaries and tubes showed dense adhesions. Gonorrhea probable.

The specimen consists of an organized blood clot, apparently in the middle of the tube, with a fimbriated extremity attached. The clot is organized in the middle with numerous fresh hemorrhages nearly 1 cm. in diameter on the periphery. There is an irregular cavity, 8 mm. in diameter, lined with a smooth membrane, filled with a granular mass and blood (chorionic cavity). Sections were taken from the central end of the enlargement, through the middle of the enlargement, and through the distal end of the tube. The section through the central end shows an organized clot without any tube wall surrounding it. Evidently it was stripped off in the operation. The

whole clot is permeated with bands of fibrinoid substance, between which are scattered necrotic villi. In the center of the block is an irregular cavity about 1 cm. in diameter, containing a dense mass of cells which take the hematoxylin stain well, and presenting every appearance of a section through an embryo; however, none of the more solid portions of the embryo can be seen. It appears as if the cells had broken up, forming a "stew" in which the largest particles are individual cells. A section through the middle of the enlargement also shows strands of fibrin and scattered villi. Upon the tips of some of these villi are some trophoblast cells. On one side of the tube wall is a single gland-like structure burrowing into the muscle. Section through the outer end of the tube shows that the lumen is filled with well-formed folds, some of which are adherent. It appears, however, to be normal.

## No. 808.

(Dr. J. M. Hundley, Baltimore.)

(Plate 1, fig. 4, and plate 11, figs. 3, 4.)

Normal embryo, 4 mm. long. Operation, December 11. No infection, no venereal disease, and at time of operation the uterus and ovaries appeared to be normal. Patient aged 23; married; has one child, 2 years old; no miscarriages. Menstruated the third month after the birth of the baby and without pain. Menstruated each month normally and at the proper time up to November 1913. Did not skip a period and they were not delayed. On November 25 the menstruation began and lasted for a day. On November 29 she had a hemorrhage, which lasted for a few minutes and then ceased, but recurred December 3. She suffered severe pain from November 25 to December 11, the day of operation.

The specimen consists of a distended tube, measuring 70×25×25 mm. It is attached and lying in the broad ligament with an adjacent spherical tumor, 50 mm. in diameter, which appears to be a cystic ovary, on one side of which is a crescent-shaped corpus luteum. The tube was cut through the middle and found to contain a blood clot separated by about 1 mm. from the tube wall. The first section went directly through the embryo, cutting it into 3 parts. The cavity containing the embryo measured 3 mm. in diameter and extended a considerable distance down the center of the tube. As the specimen had been hardened *in toto* in formalin, the parts of the embryo were not injured, so that they could be easily drawn and each cut into serial sections. The form of the embryo was sharply defined, with beautiful arm buds.

The form of the tube and its adjacent cyst is well shown in the drawing. Sections were cut from many parts of the tube, permitting a careful reconstruction of the specimen. The section through the uterine end of the tube shows a small lumen with delicate folds and no sign of inflammation. Within the lumen of the tube is a clump of cells which appear to belong to the ovum. At the beginning of the distended portion the folds are very pronounced and contain very large spaces lined with endothelium and filled with clear fluid. Some of these spaces extend through the bases of the folds into the tube wall. They look very much like lymphatics. At this point the contents of the tube are composed mostly of an organized blood clot. The folds are not adherent, nor are there any outgrowths of the epithelial cells into the muscular wall. A little nearer to the embryo the section contains many active villi, with a very extensive trophoblast adherent to the tube wall all around. The lumen of the tube is sharply defined on one side of the clot. It contains an organized mass, but other-

wise appears to be normal. The proper interpretation of this specimen is that the ovum has implanted itself in the tube wall between the lumen and the broad ligament. Section through the middle of the ovum shows the same relation as given above, but the tissue between the lumen of the tube and the chorion is composed partly of a thick layer of trophoblast, although mainly of a large necrotic plug into which there have wandered a number of leucocytes. This section is through the part of the chorion containing the embryo, but in this as well as in all the rest there is no remnant of an amnion. Possibly the entire amnion was removed with the embryo. The coelom is filled partly with a delicate magma and partly with granular magma, which takes the hematoxylin stain. These mucin-like particles are often stratified and a few of them have layers which encroach on central ground. Apparently we have here a substance which I have frequently described as granular magma. Large patches of flakes like these are often seen in specimens of tubal pregnancy. The cavity of the chorion continues within the tube wall for about 1 cm. and suddenly reappears within the lumen itself. In other words, we have here an interstitial implantation of the ovum which has ruptured in the tube wall in both direc-



FIG. 18.—Outline of tube attached to ovary which contains a large cyst (No. 808). The dimensions of the pregnancy and of the tube lumen are indicated by the dotted lines. The lumen itself is long-drawn-out and lies in the center of the clot.  $\times 0.75$ .

tions, extending outward to the fimbriated end of the tube. The chorionic mass extending outward has in it an irregular coelom. Where the embryo is located, the space is 5 mm. in diameter. It is reduced to 2 mm. at the point of the entrance of the clot into the tube lumen. Further on it is smaller, but then becomes larger again. In other words, the ovum is elongated and constricted. The outer dilatation contains a very small vesicle, which does not communicate with the embryo. As it is not an extension of the umbilical vesicle, it appears to be a detached portion of it. Further downward the umbilical vesicle disappears and here the coelom is completely filled with a dense reticular magma. In this region the mesoderm of the chorion is of very irregular thickness. Some of the cells ramify through the magma and at other points there seems to be a complete rupture. At any rate, numerous groups of maternal red blood corpuscles are scattered through the magma fibers. As the specimen was hardened *in toto* and as the sections were cut in celloidin, these corpuscles must have entered the coelom before the operation. Beyond the clot the folds of the tube are again well pro-



nounced, but show no signs of inflammation. Here, as throughout the tube lumen, the "large lymphatic spaces" within its folds are greatly distended.

In general the form of the embryo and its tissues and organs seem to be normal. The lens is just beginning to form. The spinal cord, however, shows marked histolysis in the dorsal region. The change begins on the ventral side of the upper cervical cord and reaches its maximum in the middle of the back, where the ventral two-thirds of the cord has broken down. In the neighborhood of the leg the cross-section of the cord is hourglass-shaped, with a lumen in each half. Although the destructive changes in the ventral side of the cord are so very severe, numerous cell divisions are present in the dorsal side, an evidence that it is continuing to grow.

#### No. 809b.

(Dr. Lowsley, New York.)

Ruptured tube from which a large clot protrudes. The entire mass measures  $60 \times 40 \times 30$  mm. The clot, which is peeled out with great ease, is solid and appears to be unorganized. It measures  $45 \times 25 \times 20$  mm. Sections were cut through the distal and proximal ends of the tube and through the clot. Section through the proximal end shows that the tube lumen is normal in form, but the folds seem somewhat thin and dovetail together. They are markedly infiltrated with leucocytes. The section through the distal end, however, shows no folds in the lumen. The tube wall is matted together and hyperemic with muscle bundles running in all directions. Instead of single large folds, we have a few hyperemic folds, markedly inflamed, with outgrowing pockets of epithelial cells into the tube wall. Somewhat nearer to the uterus the tube wall has in it a great many pockets, less than a millimeter in diameter, each of which has its own accompanying muscle-wall. It seems like an active effort towards regeneration of the tube lumen. In this region there are at least 50 of these lumina. The clot, which is protruding from the rupture, appears to be quite fresh, but it is more or less cut up by thin bands of fibrin, which are associated with myriads of leucocytes. A few necrotic villi are present.

#### No. 809c.

(Dr. Lowsley, New York.)

Tubal mass,  $80 \times 45 \times 35$  mm. Operation in Bellevue Hospital, July 25, 1913. Last regular menstrual period, July 15. The specimen came to the laboratory unruptured, with an artificial constriction in the center, due to a band which had been tied around it. Practically the entire tube is distended; in its proximal portion the pregnancy is contained within the tube wall, but protrudes from it into the lumen more distally. Sections were cut from four portions of the tube. In the outer third, the collapsed ovum was found. Section through the uterine end shows that the mucosa is practically normal. Possibly the folds are hyperemic. Sections between the uterine end and the ovum show that the clot has invaded the tube wall throughout the greater part of the circumference, leaving a small space on one side which may represent the lumen of the tube. Into this space a few tubal folds protrude. The clot is well organized and permeated with an irregular mass of villi, many of which are necrotic. The trophoblast is quite active and invades the tube wall; in some places it has intermingled with it large masses of leucocytes. Toward the outer end of the tube, near the ovum, the clot has become entirely separated from the tube wall. It appears as though we have a more advanced stage in

this specimen than that shown in an early stage in specimen No. 808. The wall of the collapsed ovum appears to be necrotic and at many points is being invaded by leucocytes. The villi are long and slender; many of them reach the tube wall. The periphery of the clot is encircled by one mass of leucocytes. Between the clot and the tube wall is a curious granular mass which takes the hematoxylin stain and is especially well marked with the Van Gieson stain. Possibly this may be a mucoid secretion, or it may be granular magma; it is occasionally seen in other specimens. The mucosa of the tube wall is of about normal thickness and is hyperemic; in places the adjacent folds are united. This condition is much more pronounced in the outer end of the tube. Here there is a very marked inflammation of the tube folds, which are agglutinated. We have here a marked salpingitis. In this specimen the inflammatory process is pronounced in the distal, but not in the proximal, end of the tube.

#### No. 815.

(Dr. Leonard, Baltimore.)

Tubal mass,  $50 \times 30 \times 25$  mm.

The specimen came from a colored woman, 39 years old, who had been married 10 years and had had one child, 9 years old, but no miscarriages. The last period began December 1, 1913. Operation, January 7, 1914. Her periods had been irregular for some time and there were indications of chronic inflammatory disease; probably gonorrhea. At the time of the operation (January 7, 1914), it was found that the tube and the uterus were involved in extensive adhesions.

The specimen consists of the left Fallopian tube (from which the ovary has been dissected away), measuring 8 cm. in length. Extending to within 2 cm. of the fimbriated extremity and beginning 1 cm. from the uterine end, the tube consists of a large oval mass,  $5 \times 3 \times 3.5$  cm. The top and posterior surface of this mass is deeply blotched by what appears to be a large and rather firm subjacent clot of blood, making up most of the tumor. An abundance of small tortuous venules run over the surface of the tumor. The fimbriated extremity of the tube is open, as determined by a blunt probe (1 mm. in diameter). Cut adhesions are abundantly evident from many points of the surface of the tube. With a razor two complete trans-sections of the mass were made, one near the outer pole, the second at the mid-portion of it. The latter disclosed distinct, small chorionic cavity, in which no embryo was visible. The specimen was immediately fixed in 10 per cent formalin at  $40^{\circ}$  C.

Sections were cut through the distal and proximal ends of the tube, and two sets through the middle of the distention. Sections through the uterine end of the tube show that the muscle wall is well formed and apparently normal, but practically all of the epithelial lining of the lumen has been exfoliated. Some new flattened cells are still adherent, but more are found free in the tube lumen. Sections through the outer end of the tube show that the lumen is quite small; the folds are hypertrophic and more or less matted together by a muco-purulent exudate. In fact, the stroma of the folds is also much infiltrated with leucocytes. At the bottom of the folds are numerous villus-like processes. All these findings indicate the presence of a follicular salpingitis.

Sections through the cavity of the ovum show that the chorion is mostly fibrous and contains no blood vessels. The trophoblast forms occasional nests upon the chorionic wall and in places is invading it. The tube wall is mark-

edly inflamed and contains abscesses. Its epithelial lining has disappeared entirely. The chorion is star-shaped; the tips of the processes are encircled by a mass of fresh blood. Between these processes are older hemorrhages in which the corpuscles are no longer well defined. Within the second area are numerous necrotic villi. Those within the first area, which still communicate with the chorion, take the stain well and are covered with an active trophoblast. It appears as though the fresh hemorrhage in these specimens is favored by the presence of live villi, and that in turn this hemorrhage causes the trophoblast to be more active.

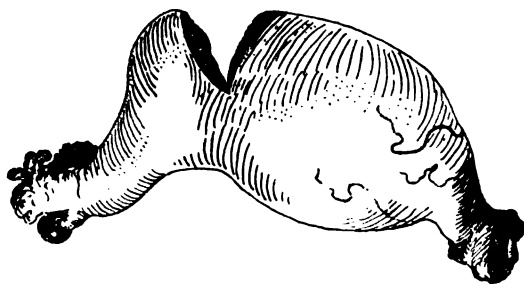


FIG. 19.—Outline of specimen No. 815.  $\times \frac{1}{2}$ .

No. 825.

(Dr. Vest, Baltimore.)

(Plate 9, figs. 4, 5.)

Specimen,  $90 \times 40 \times 25$  mm.

Unmarried colored woman, age 29 years. Last menstrual period, January 2, 1914. Bloody discharge, January 26. Abdominal discomfort, especially in iliac fossa, for 3 weeks. She probably has a mild chronic gonorrhea.

At the time of the operation it was found that the ovaries, tube, and uterus were covered with adhesions and were very vascular. A small corpus luteum was found in the right ovary. The fimbriated extremities of both tubes were open. The uterus is normal in size and consistency, and the ovaries appear to be normal, except for the adhesions. About 50 c.c. of fresh blood, including fresh clots, were found in the abdominal cavity.

The specimen consists of the entire tube with the ovum lodged in its outer half. It is unruptured and bound together with numerous fibrin bands, as shown in the figure. The wall is very vascular. The whole specimen measures  $90 \times 40 \times 25$  mm. On the distal or abdominal end two openings are seen; the lower one appears to be normal, whereas the upper one may possibly be due to a mechanical injury, which has allowed the folds to protrude, this simulating a second opening. The specimen was cut through the point of its greatest distention, and the section seems to include the chorion in its greatest diameters. It is covered with a well-formed membrane, which encircles the whole ovum, but the wall is somewhat thin at the point at which it is destined to rupture. What is especially remarkable is that the ovum contains two sharply defined cavities, separated from each other by a transverse membrane. This septum is composed of two layers, the space between them being encircled by a wreath of invading villi. Both cavities appear to be amniotic, but contain no trace of an embryo; however, under the membrane lining the outer cavity there is a small club-shaped nodule, about 2.5 mm. long, which may be the embryo. Sections will be required to determine this point. Projecting from the outer cavity is an extension, which is shown in the figure. This extension protrudes from the ostium, which is described above as possibly an artefact. The real ostium does

not seem to contain a lumen. This must be determined by sections.

The specimen was cut in the middle, revealing the double ovum described above. On one side of one of the cavities was a small white body, which was cut into serial sections. It was found to be composed of a necrotic mass of trophoblast infiltrated with leucocytes and lying on the outside of the chorion; otherwise, no embryo could be found. Sections through the uterine end of the tube show that the mucosa is made up of marked folds which are much infiltrated with polymorphonuclear leucocytes. There is a fibrinous exudate within the lumen. Sections through the fimbriated end of the tube reveal quite a normal mucosa with some fibrinous exudate. A section through the middle of the tube, as indicated in the figure, discloses a double ovum with a membrane separating two cavities. Each ovum is lined with its own mesoderm, from which strands pass into the coelom. No trace of an amnion in either cavity. In the larger coelom is a rich tuft of magma arising from a small nodule, which may represent the remnant of the embryo. This is somewhat encircled with strands of mesodermic tissue and contains several epithelial-like cells. The membrane separating the two ova is double and composed only of the chorionic wall with but little trophoblast between the two layers. The villi have a tendency to separate this membrane, as shown in the figure. The villi are well covered with trophoblast and there is an outer shell of fibrinoid tissue, which takes on an intense eosin stain. Beyond this is the tube wall, which is more or less infiltrated. The spaces between the villi are mostly empty, partly filled with trophoblast intermixed with a scanty amount of blood and partly filled with small organized clots containing many leucocytes.

No. 835.

(Dr. Harvie, Troy, New York.)

Unruptured tube,  $40 \times 30 \times 30$  mm. From a white woman, 35 years of age, this being her fourth pregnancy. She had had two children, 9 and 6 years old respectively, and had had an abortion 3 years previously at the end of the second month. The periods had occurred on November 1 to 4, 1913; December 8 to 19; and January 12 to the time of operation. (Specimen received February 9.) At the time of the operation the uterus was found to be normal as to location and mobility; there was no indication of venereal disease, nor of tubal or ovarian trouble. The specimen consists of a tube which is very much distended by an oval mass measuring  $40 \times 30 \times 30$  mm. A cross-section of it shows that it is composed chiefly of a compact red clot, in the center of which a dark area, 12 mm. in diameter, is seen. Throughout the clot are scattered white pieces of chorionic villi.

Sections through the uterine end of the tube show that it is normal in appearance. The folds, however, are quite pronounced and seem to be hypertrophied. The same is true of the abdominal end of the tube; here also is no indication of inflammation. Sections through the enlargement of the tube show that it is mottled and is composed of two zones: an inner, fibrous and organized, and an outer, composed of fresh blood. The mass has implicated completely half of the tube wall, while in the other half the lumen is present. In it the folds also seem to be normal. A few scattered villi are present, and several long fibrous villi permeate the clot. The trophoblast is scanty, excepting on one side, where it shows activity at the point of juncture of the clot with the tube wall. There is some inflammatory reaction in the tube wall.

## No. 838.

(Dr. Kittridge, Nashua, New Hampshire.)

(Plate 11, fig. 2.)

Clot, 25 mm. in diameter, contains a pathological embryo, 6 mm. long.

The woman, a patient of Dr. A. E. Wallace, did not suspect pregnancy, but was sent to the hospital with the usual abdominal symptoms. She was immediately operated upon and a rupture of the tube was found near the uterus with the inclosed specimen protruding. The specimen consists of a dark chestnut-shaped mass,  $27 \times 23 \times 29$  mm. From the middle of one of the flattened sides white chorionic villi protrude. A cut through the specimen disclosed a spherical smooth-lined cavity, about 9 mm. in diameter, into which projected a nodular opaque white embryonic rudiment, measuring about 6 mm.

"The clot" consists of the chorion, which is hemorrhagic; from one side a tuft of white villi protrudes. The cavity within contains a very much deformed embryo. The wall of "the clot" is well organized and permeated with strands of mucus leucocytes, which in turn are being invaded by long lines of trophoblast cells. The villi show all grades of degeneration, mucoid and fibrous. Some are necrotic and others appear to be very active. Upon the tuft of protruding villi the trophoblast is as well defined as in the normal chorion. The tissues of the embryo are thoroughly dissociated, but the central nervous system can still be made out. This is all of the anatomy which can be determined with certainty. On the external surface, as the illustration shows, are prominences which may represent the extremities.

## No. 846.

(Dr. Elting, Albany, New York.)

Ruptured tube,  $85 \times 40 \times 30$  mm., contains a pathological embryo, 8 mm. long. The specimen comes from a white woman, 45 years of age, who has had four previous pregnancies, the first 20 years ago, the last 10 years ago. On January 7, 1914, she had pains low down in the abdomen. On January 10 she passed what was thought to be an embryo and membrane [decidua]. On January 13 the flow began, and continued for 6 days. On February 2, at 2 p. m., there was some pain in the lower abdomen, with hemorrhage. She was brought to St. Peter's Hospital late the same night. At the operation on the next day the uterus was found moderately enlarged. The left



FIG. 20.—Outline of specimen No. 846, before it was cut into sections. The cavity within is indicated by the dotted line.  $\times \frac{1}{2}$ .

tube was distended and there had been an extensive hemorrhage from it into the abdominal cavity. There was no evidence of any infection or venereal disease. The right tube and ovary were normal. The uterus was 1.5 times its normal size. The specimen consists of an unruptured tube,  $85 \times 40 \times 30$  mm. It is quite evenly distended (fig. 20). On section, it is found to be composed of a well-organized clot, containing within it a cavity  $15 \times 10 \times 5$  mm. Part of this is filled with a dense reticular magma,

probably the cavity of the amnion. The tube wall is covered with a dense layer of well-developed blood-vessels. This finding illustrates again the fact that the vascularity of the tube does not indicate that it contains a normal embryo.

Sections were made of the tube through its largest diameter, and also through the uterine and fimbriated ends. The uterine end appears to be perfectly normal, showing delicate folds of mucous membrane and fully developed circular muscles. At the fimbriated end the folds are somewhat adherent, and into the lumen protrudes one very large fold with immense blood-vessels. This, and the wall surrounding the tube, are infiltrated with many leucocytes, showing that an active inflammation is present. The section through the distended part shows that the tube wall has been almost entirely destroyed, but its side is occupied by large accumulations of leucocytes. The clot is mottled, showing that fresh hemorrhages are taking place. The chorionic wall is partly necrotic and has been invaded by numerous trophoblast cells, which in some places form small mounds. The villi ramify through the organized clot, some of them reaching its surface. At some points the trophoblast is active, especially where it comes in contact with the invading leucocytes. What appears to the naked eye to be magma proved to be a dissociated embryo. The central nervous system can still be made out sufficiently to determine its size. Sections were not serial, so it is impossible to obtain a complete description of the specimen. Although there is no history of infection, the inflammatory reaction of the tube wall is too severe to be accounted for simply by the presence of the ovum.

## No. 851.

(Dr. Sexton, Baltimore.)

Ruptured normal embryo, CR 52 mm. The specimen came from a white woman, aged 36 years, this being her third pregnancy. There was no history of any venereal disease. She was married in 1904 and has two living children. Her last period began December 23, 1913. Her physician, Dr. Seldner, sent her to the Hebrew Hospital, where an operation was performed by Dr. Ney on March 9. Dr. Sexton described the fetus as being free from the tube, but still attached by its cord and apparently living at the time of the operation.

The specimen consists of a collapsed ruptured tube about 50 mm. in diameter, from which protrudes what appears to be a normal ovum covered with rich villi. The collapsed ovum is about 40 mm. in diameter. Transverse sections show that it is for the most part detached from the tube wall, but is well implanted on the side. A section was taken from the middle of the attachment of the chorion to the tube wall. The chorionic wall, as well as the tube, is quite fibrous, but apparently normal for this stage. The villi are long and slender and covered with small tufts of trophoblast, showing a slight amount of blood between the tips. There are active necrotic masses of trophoblast between them. The zone between the tips of the villi and the tube wall is composed mostly of fibrinoid tissue, which grades over into the tube wall. This zone has in it also a large accumulation of leucocytes, which at some points seem to be forming small abscesses. The fibrinoid tissue has been invaded by trophoblast cells and often suggests the appearance of cartilage. At one point in the specimen the fibrinoid tissue has been penetrated by the trophoblast cells which are puncturing the blood vessels, from which a small amount of blood streams into the intervillous spaces. Wherever flow comes in contact with the trophoblast a syncytium seems to form which is more or less vacuolated.

It appears then that the cavity of the ovum is lined by a layer of fibrinoid tissue, to which the villi attach themselves and occasionally perforate it to gain nutrition from the blood vessels of the tube wall. In many respects the conditions here do not differ much from those found in the uterus as described by Grosser.

No. 867.

(Dr. Branham, Baltimore.)

Ruptured tubal pregnancy with a normal embryo, CR 37 mm.; separate ovum, and broken embryo. The operation was performed by Dr. Branham on April 9, 1914, at Franklin Square Hospital. The ruptured tube was sent to the laboratory, fixed in neutral formalin, 3 hours after the operation. The ovum is collapsed and covered with some very long, well-developed villi with numerous opaque white nodules, about 1 mm. in diameter, attached to them. The collapsed tube is  $60 \times 35 \times 30$  mm.

Sections were cut through the uterine and fimbriated ends of the tube and through the middle of the implanted cavity. The folds of the uterine end of the tube are hypertrophic, markedly infiltrated, and rendered more or less adherent to one another by an inflammatory exudate. There are numerous outpocketings from the epithelial covering both into the tube wall and in the larger folds. A like condition, although not so marked, is found in the mucous lining of the fimbriated end. The implanted cavity is lined with a layer of fibrinoid tissue. It is more or less riddled by the trophoblast and has attached to it on its inner side numerous tips of villi. Between the fibrinoid layer of the tube wall are some remnants of the folds of the tube and often patches of inflammatory tissue. Some of the villi have also reached this same zone (between the tube and fibrinoid zone).

No. 874.

(Dr. Vineberg, New York.)

(Plate 11, fig. 1.)

Tubal mass,  $80 \times 30 \times 25$  mm., with a fragment of an embryo 1 mm. long. The specimen came from a Jewish woman, aged 27 years, married 4 years, and the mother of one child. The last period began February 23, 1914, and the operation was performed on April 15. The first symptoms began April 1, when the patient complained of abdominal pains. At the time of the operation the uterus appeared to be normal and there were no signs of inflammatory or venereal diseases. The specimen, which came fixed in formalin, is kinked upon itself and irregularly distended, as shown in the figure. The clot is protruding through the abdominal opening, and opposite this point is a small perforation. Between the distended portion of the tube and the one near the inner opening is a contraction of the tube wall. The specimen was cut into numerous small blocks which disclosed to the naked eye an ovum near the abdominal end in process of abortion. No chorion is present at the point of contraction between these portions of the ovum.

Sections were made through these regions of the tube, and the microscopic examination confirmed the observations made by the naked eye. A section through the uterine end shows large tubal folds projecting into the lumen. The muscular wall seems hypertrophied, and there is an inflammatory reaction in the tissues of the folds. The block through the distended area near the uterus (marked 2 in the drawing) passed through the tube lumen and a mass of chorionic tissue is implanted within the tube wall. It is clearly a case of interstitial implantation. The implanted cavity is surrounded by a layer of trophoblast and the ovum consists of a general conglomeration of

villi, trophoblast, syncytium, and fresh blood. At a place 25 mm. beyond this (marked 3 in the figure) we have the same mix-up, to which is added a collapsed and torn chorionic membrane. Here the chorionic mass lies within the tube lumen. At one point is the remnant of an embryo, which seems to be composed of the body wall. Its tissues are also intermingled with maternal blood, and there are signs of irregular growths resembling a tissue culture. This fragment from the embryo is about 1 mm. in length. Judging by its shape it should have come from an embryo about 7 mm. long. At no point is the trophoblast attached to the tube wall; the tube wall, however, shows inflammatory reaction and the spaces within the folds are filled with an unusually large number of leucocytes. The trophoblast covering the villi, which are intermingled with fresh blood, is very active, but these clots are partly organized. Beyond this, at the point marked 4, the tube lumen contains blood, but no remnant of the chorion. A section through the outer end of the tube includes the point of rupture and the abdominal opening. It contains a large piece of ruptured ovum with numerous villi and trophoblast and maternal blood, some of which lies within the coelom. The chorionic wall and the mesoderm of the villi are quite fibrous and a good portion of the trophoblast is necrotic. The clot surrounding this mass is more highly organized and has in it numerous strands of leucocytes, which at some points are destroying the villi. At the bases of some of the folds of the tube are marked pockets. There are also large flakes of granular magma taking on the peculiar hematoxylin stain in this portion of the tube.

We undoubtedly have in this specimen an ovum which has broken in half; one part has remained near the point of implantation, while the other has moved to the outer end of the tube and is being aborted. The part near the point of implantation is fresh and normal in appearance. The part being aborted is fibrous and necrotic, showing that when fully detached from the tube wall the ovum has difficulty in finding adequate nourishment.

No. 881.

(Dr. Neel, Baltimore.)

Tubal mass,  $110 \times 35 \times 35$  mm., containing a pathological embryo 3 mm. long. The specimen came from a white woman, who had been married 16 years and who had had seven children, the youngest 2 years old; no previous abortions. She was operated upon April 30, 1914. The periods had been regular. The last had begun 4 weeks previously and continued until the time of the operation. No history of venereal disease. At the time of the operation a few adhesions were found on the outer third of the tube; otherwise, the pelvic organs were normal. Over a liter of blood was found in the peritoneal cavity.

The tube was quite evenly distended. After being fixed it was cut into slabs about 15 mm. thick. One of the cuts is 40 mm. from the outer end and passes through the amniotic cavity, which is  $5 \times 7$  mm. in diameter and contains an atrophic embryo, about 3 mm. long. The contents of the rest of the tube appear to consist mostly of fresh blood. In the neighborhood of the embryo the ovum is attached to the lateral border of the tube; elsewhere the tube is lined with flattened folds. The clot is not attached to the tube wall except at the point of implantation. The opening at the fimbriated end seems to be obliterated. From an examination of the specimen we would conclude that there had been no escape of blood into the abdominal cavity.

The uterine end of the tube is distended, and projecting into it are small finger-like processes, but no inflammatory

reaction is present. The fimbriated end has a small lumen and the folds are more or less adherent. The thicker folds are invaded with gland-like invaginations and there are also numerous villus-like processes. In this region there is a marked fibrinous exudate. The distended portion of the tube is filled with a partly organized clot, within which are numerous leucocytes. Throughout the clot are a few scattered villi, which have undergone marked fibrinous degeneration; many of them are encircled with hordes of leucocytes. The epithelial wall of the tube is intact around the entire clot. The embryo, which is located in a small cavity, is greatly deformed and its tissues are almost completely dissociated. The central nervous system can still be made out and the heart is a mass of round cells. Two lenses are still adherent to the epidermis upon the sides of the head. The sections through the chorion show that its walls are degenerating and that the villi are becoming fibrous. The trophoblast is scanty. The tubal wall is somewhat inflamed, and at the point of implantation is invaded by trophoblast cells.



FIG. 21.—Section through tube to show the extent of the blood clot within a cavity containing the embryo (No. 881).  $\times 2$ .



FIG. 22.—Sketch of embryo from No. 881.  $\times 8$ .

In this region the inflammation is more marked than elsewhere. Within the clot the leucocytes are accumulating in masses, especially around the dead villi.

#### No. 882.

(Dr. Sexton, Baltimore.)

Tubal mass containing a pathological embryo 8 mm. long. The patient was a white woman, 34 years old, with 3 children under 7 years of age. She had had two abortions, one at the end of the second month and the other at the end of the third month. D and C 10 years before; inguinal glands excised 9 years before. Operation May 1. Normal menstruation 3 months before; 2 months before she began to have a little staining of dark blood, which continued for 7 weeks; she then suddenly passed a large amount of blood. After that she had a small amount of bleeding daily, but very little pain. Sharp pain one week before operation, lasting about 2 hours, and subsequently three other attacks.

Left tube and ovary sent to laboratory. Chronic salpingitis, gonorrheal on the right side. Uterus normal. Appendix chronically inflamed, atrophic. The unruptured

tube was brought to the laboratory fresh. On the outer surface were several indications of rupture, although in reality it had not ruptured anywhere. The fresh tube ( $60 \times 45 \times 40$  mm.) was opened in saline solution. In thickness the wall ranges from 10 to 15 mm. and is permeated with villi and bands of fibrin with numerous spots of fresh hemorrhage. The cavity within is  $20 \times 15 \times 12$  mm.; it is lined with a smooth membrane and has within it a large clot of blood. With difficulty the membrane surrounding this cavity was torn and after it was dissected away the embryo came into view. The embryo is very white and opaque and has a knob-like head and no extremities. Although the dissection may have distorted the specimen, it looks as though the embryo had been dead for some time. From all appearances it seems as though the blood clot had entered the amniotic cavity and that the amnion had been torn before the clot could pull off the embryo. The clot was thoroughly coagulated and only with difficulty could be peeled from the embryo.

Sections of the embryo show very decided changes, as the tissue is completely dissociated. Nevertheless, the external form of the embryo is well retained. The uterine end of the tube has hypertrophied folds, with numerous outpocketings of epithelial cells; also villus-like processes, a few of the folds adherent. The lumen contains an inflammatory exudate. At the point of distention the wall is markedly inflamed and the clot is more or less adherent. Where the epithelial lining is intact, the folds are united, forming pockets; that is, there is a localized follicular salpingitis. The chorionic wall and villi are fibrous and covered with a scanty amount of trophoblast. The encircling blood clot is not well organized and many of the villi are necrotic and have been invaded by leucocytes.

#### No. 889.

(Dr. Logan, Changteh, Hunan, China.)

Pathological ovum in tubal mass,  $50 \times 25 \times 15$  mm. On March 28, 1914, Dr. Logan writes the following history: "Extra-uterine (tubular) pregnancy. No. 89-14, Changteh Hospital. Aged 32; occupation, trained nurse. Race, Chinese. Menstruation began at 14, was regular until 19. During her nineteenth year the patient became much emaciated and had a cough. During this time she missed four periods. Amount of flow moderate, painful during the first day only. Was married January 18, 1913. After marriage she did not menstruate, becoming pregnant at once. The child was born at term, but died during a difficult breech delivery. After the child was born the patient was in bed for 20-odd days. The lochial discharge did not cease for over 30 days after delivery. About 40 days after the lochial discharge stopped, she menstruated. The flow was greater than usual, but otherwise was not abnormal. It lasted  $4\frac{1}{2}$  days.

"Extra-uterine pregnancy flow. From the time the above last menstrual flow began until the 'show' of the extra-uterine pregnancy, was 33 days. Patient remembers distinctly (it is remarkable how the Chinese remember the exact day any particular illness began). On the first day the flow was very slight; the second day it was very little more, but the pain in the back was intense. From the third to the eighth day of the flow the pain was intense in the back and suprapubic regions, also in the left leg. The show was increasingly abundant, but never copious up to the eighth day after it began. On the eighth day after the flow began (41 days after the beginning of the last normal menstruation) the patient fell unconscious. She was seen 5 minutes later by the operator, who found her semi-

conscious, with a rapid pulse and colorless face. The operation was performed as soon as the instruments could be sterilized.

Operation: The abdomen contained a large quantity of blood and clots. The left tube was clamped and removed. The patient made a good recovery with primary union of the wound. Ten days after the operation patient had an acute attack of what seemed to be gallstone colic, which lasted a day. The decidual cast (sent with specimen) was passed a few days after the operation."

The specimen consists of numerous large blood clots about 30 mm. in diameter. The flattened decidua measures 50×30 mm. and the brownish unruptured tube, somewhat bent upon itself, measures 50×25×25 mm.

Sections of the decidua show that it is unusually well developed. Very large decidua cells line the cavity of the uterus, and through the decidua are seen very large venous sinuses and also numerous degenerated uterine glands. Sections through the uterine end of the tube show that it is lined with small villi and filled with a clot, extending from the main hemorrhagic mass of the tube. The folds are filled with leucocytes. The main mass of the tube contains a fairly well-organized clot, around which is a complete tube, well covered with a continuous layer of epithelium. Some of the folds are very hemorrhagic and the tube wall in general is inflamed. In a cleft within the clot is a mass of active trophoblast about 2 mm. in diameter. The syncytium is pronounced and often vacuolated, containing fresh blood-corpuscles. The tips of the villi reach into this mass, but the connection with the tube wall is not shown in the section. On the outside of the tube a large clot of typical granular magma is seen. It is about 3 mm. in diameter and is composed of small granules encircled by a variety of streaks which take on the characteristic hematoxylin stain.

## No. 891.

(Dr. Leonard, Baltimore.)

Tubal mass, 60×30×30 mm. The specimen is from a white woman, aged 30 years, who has been married 13 years and has two children, aged 12 and 10 years. She has had two miscarriages, one at 5 months and one at 6 weeks. No history of venereal disease. The menses began at 13 years and were regular every 4 weeks with a moderate flow lasting 4 to 5 days. There has been only a slight flow since an operation (6 years ago), occurring regularly once a month. Two weeks before an operation for dilatation and curettement she had constant vaginal bleeding, varying in amount, often containing large clots. A few days before operation she had an attack of severe cramping in the abdomen, without vomiting, which lasted 3 or 4 hours. After being discharged from the hospital she was readmitted on May 10, complaining of same pain in the lower abdomen and continuous bleeding. She was operated upon May 12, when an unruptured right extra-uterine pregnancy was found. Unruptured tubal mass, 60×30×30 mm. It was incised and found to contain a solid clot. It was then fixed without further manipulation. One day later (May 13) new sections were made and a collapsed ovum was found about 5×10 mm., which was entirely surrounded by fresh hemorrhages.

The uterine and fimbriated ends are distended with an exudate which is rich in leucocytes. The wall of the tube is infiltrated with polymorphonuclear leucocytes. The distended portion of the tube contains a collapsed ovum and the villi are largely necrotic. The blood clot is not well organized, but contains many leucocytes. The wall

of the necrotic ovum is one mass of them. There is no active trophoblast. In this specimen the tube has ruptured opposite its greatest distention, and the opening has been plugged by clots of blood protruding into it. The ends of the ruptured tube are "healed" into the clot. There is a good deal of granular magma on the outside of the tube.

## No. 892.

(Dr. Leonard, Baltimore.)

Unruptured tube, 90×45×45 mm. From a white woman, aged 39, who has been married 21 years and has 7 children, the oldest 20 and the youngest 7 years old; no miscarriages. The second and fourth deliveries were instrumental, but uncomplicated. The menses began at 13 years and were regular every 4 weeks. Duration, 6 to 7 days, with a profuse flow but not especially painful. Last period, February 25; preceding period, January 24 or 25. About April 23 patient had sharp bearing-down pain in the lower abdomen. About a week later she began to have a slight show of blood and passed a large clot. She has had a constant slight bloody discharge ever since. Operated upon at the Johns Hopkins Hospital, May 14, 1914.

The unruptured tube was cut into blocks; the section was mottled and well organized. No embryo was found.

In the uterine end of the tube numerous large outpocketings reach far into the muscularis to end blindly. In the middle of the distended portion the section struck the ovum, which is collapsed and contains no lumen. From the chorion long fibrous villi extend, a few of which reach to the tube wall. The latter is markedly infiltrated with leucocytes and trophoblast cells, indicating that there was a good early implantation as well as an infection. At some points there are abscesses. The tube lumen extends about one-fourth around the wall and is lined with adherent folds, which form pockets; in other words, a localized follicular salpingitis is present.

## No. 898.

(Dr. Hunner, Baltimore.)

Tubal mass containing embryo 15 mm. long. The woman, aged 27 and married 8 years, had never been pregnant before. She has had regular periods lasting 3 or 5 days. The last period began 28 days before the operation. During the intervening time there has been some irregular black discharge. She had a peritonitis-like attack 5 days before the operation. At the time of the operation there were free clots of blood found in the peritoneal cavity. The left tube, containing the pregnancy mass, was removed. There were some adhesions about the right ovary. The clot, 60 mm. in diameter, is attached to the tube, which measures 50×25×25 mm. After separation it was found that at the point at which the fimbriated end was embedded in the clot there was a cavity containing a macerated embryo, 15 mm. in length. The embryo was still inclosed in the amnion, which in turn was encircled by coagulated blood.

The uterine end of the tube contains marked hypertrophied folds and some exudate. At a point 25 mm. from this end, and midway between it and the distended tube, is a very active inflammatory process, the folds being adherent—a follicular salpingitis. There are many finger-like processes from the folds, which extend into the lumen of the tube as well as into the follicles. The mucosa of the distended portion is interesting from the fact that the changes, which took place after the abortion of the normal embryo, are shown. In this region a follicular salpingitis is also pronounced. There is much fibrinous degeneration



and the follicles are filled with inflammatory exudate. The trophoblast cells and many leucocytes have invaded the folds of the tube as well as its main wall. In certain regions the trophoblast is very active. The process required to clear up the tube and return it to its normal condition, after the tubal abortion, is probably just at its beginning.

No. 899.

(Dr. G. P. Evans, Baltimore.)

Ruptured tube containing normal embryo, CR 13 mm. White woman, 29 years old, pregnant once before, having a child 3½ years old. The last menstrual period began about 3 weeks before the operation, May 22, 1914. No history of venereal disease. The right tube was found inflamed. The specimen was sent fresh to the laboratory immediately after the operation. It was hardened in Bouin's fluid. It consists of a ruptured tube, measuring 30×18×15 mm. and a free embryo, which was fished out of the peritoneum by Dr. Cullen at the time of the operation. The uterine end of the tube is lined with well-developed folds, and its lumen contains a slight amount of inflammatory exudate. The fimbriated end appears to be normal. The cavity containing the ovum is lined mainly with normal and active trophoblast, intermingled with a considerable amount of fibrinoid substance. The space in which the ovum lies contains a considerable amount of inflammatory exudate, but the surrounding wall appears to be quite normal. However, the trophoblast invades the wall as in the case of a normal implantation. Apparently the rupture must have been very recent.

No. 900b.

(Dr. R. W. Hammack, Manila, Philippine Islands.)

Ruptured tubal mass, 60×45×35 mm. From a Malay woman, 19 years of age, who was married in 1908 and who had only had one previous pregnancy, a full-term child in 1910. She had been troubled with pelvic pains since September 13, 1913, and was operated upon on October 30 of the same year. At that time she was suffering with leucorrhea. A left tubal pregnancy was found.

When the specimen came into our hands it was quite fibrous in consistence. Several blocks had been removed for microscopic examination before it was forwarded to us from the Philippines. Transverse sections were taken from the uterine end of the tube and through the middle of the ruptured block. The mucous membrane of the uterine end is thrown into numerous folds, which are more or less adherent and also end in numerous villus-like processes. There is a marked inflammatory exudate and a very pronounced follicular salpingitis. The tube wall of the rupture is also well infiltrated and there is a large fibrous clot within its lumen. At the junction of the clot and the tube wall is a zone of cells, which at one side appear to be decidua, but as they have a tendency to form the syncytium and as they appear morphologically quite like Hofbauer's cells, I am inclined to think of them as such. There are numerous large outpocketings from the tube lumen and numerous accumulations of leucocytes. No trace of the ovum is found. Otherwise the specimen appears very much like one of tubal pregnancy.

No. 900c.

(Dr. R. W. Hammack, Manila, Philippine Islands.)

Pathological embryo, 6 mm. long. From a Malay woman, 26 years old, who had been married 4 years. She had aborted "once or twice" before the present pregnancy. Her last period began 3 weeks before the abortion and bleeding was continuous until the time of the operation.

The omentum was found adherent to the pelvic organs; and the left tube was distended and had ruptured at its outer end. The specimen consists of the left Fallopian tube, which is practically spherical, measuring 45×53×40 mm. A transverse section through the middle portion discloses a chorionic cavity, measuring 19×8 mm., the walls of which are made up of organized blood. A well-preserved pathological embryo with a greatest length of 6 mm. projects from the wall of the chorion.

A section through the uterine end of the tube shows that the tube wall is markedly hypertrophied and that there are numerous outpocketings from the tube lumen. Of these there must be at least 100, arranged in large clusters, reminding one very much of Brunner's gland. The tube lumen is lined with folds which are markedly infiltrated with leucocytes and some of the folds have also been invaded



FIG. 23.—Pathological embryo from specimen No. 900c. × 8.

by tube-like processes from the epithelial lining. Sections through the chorionic wall show that it is fibrous and many of the villi permeating the clot are necrotic. Others have undergone mucoid degeneration. Where the villi come in contact with the tube wall, the trophoblast is active and invades the wall, which in turn is also active and markedly inflamed. The blood-clot is mottled, apparently consisting of organized clot and recent hemorrhage. The blood-corpuscles, which are of recent origin, stain intensely with iron hematoxylin. The rest do not. The embryo is distorted and atrophic; serial sections show that it is dissociated and very much macerated. However, the position of the main organs can still be made out, although they have entirely lost their contour.

No. 900d.

(Dr. R. W. Hammack, Manila, Philippine Islands.)

Tube-wall fragments, measuring 50×50×50 mm. From a Malay woman, 35 years of age. The patient had been bleeding for one month previously and at first had been curetted. As the bleeding continued the operation was performed, when the omentum was found to be adherent to the pelvic organs; the left tube, which was in the pouch of Douglas, was adherent to the rectum, and had ruptured in its middle portion. No embryo was found. The specimen received by us consists of fragments of tube wall which together measure about 50 mm. in diameter. A section from one of the larger blocks consisted mostly of a mass of fibrin in which were embedded numerous necrotic villi. No satisfactory examination could be made of the tube wall.

No. 900e.

(Dr. R. W. Hammack, Manila, Philippine Islands.)

Tubal mass, 25×15×15 mm. From a Malay woman, 23 years old, with an uncertain history; when operated upon the right tube was found ruptured near its fimbriated end. To this mass the ovary was attached and contained a very pronounced corpus luteum. The specimen consists

of the fimbriated end of the right tube, 25 mm. in length, and a portion of the right ovary, which has been sectioned, disclosing a large corpus luteum,  $19 \times 19$  mm. The tube evidently extends from the fimbriated end to the point of rupture, whence a similar slab of tissue has been removed and whence a blood clot about 12 mm. in diameter protrudes. Sections were taken through three portions of the tube. Those through the uterine end show that the tube was quite fibrous. At certain places were several very large pockets, but no indication of acute inflammation. In the middle of the rupture the folds were very pronounced and adherent to the actively proliferating mucous membrane and there were numerous pockets in the wall. Several villi extend through the muscular coat, and these have attached to their tips a very active trophoblast. At the fimbriated end are also outpocketings through the mucous membrane into the muscular wall.

## No. 900f.

(Dr. R. W. Hammack, Manila, Philippine Islands.)

Tubal mass,  $40 \times 32 \times 25$  mm. From a Malay woman, 26 years of age, who had had 9 previous pregnancies without any abortions. The last period during June 1913; operated upon September 21, on account of continued bleeding and pelvic pains during the previous six weeks. Venereal disease was denied. At the time of the operation it was found that the right tube was somewhat enlarged and had ruptured at the outer end of the middle third. The omentum was adherent to the pelvic organs and the left tube was distended with bloody fluid. There was also a backward displacement of the uterus. The specimen consists of the right and left Fallopian tubes. The main portion of the former is occupied by the pregnant mass, which consists of a blood infiltration and a partially exfoliated wall of the ruptured tube, some villi being here and there evident. The embryonic remnants are not seen. The entire left Fallopian tube measures about  $40 \times 15$  mm. On one side this tube is distended into the vesicle, which shows a lumen 20 mm. in diameter. This cavity is lined with folds and at one point it is about to rupture. The abdominal opening of the tube is closed.

From the right (ruptured) tube sections were cut from the uterine end through the point of rupture. The lumen of the uterine end is lined with delicate folds and within it has a slight exudate. None of the folds is adherent. The section through the middle of the tube (that is, through the point of rupture) has reached the lumen of the tube at several points and shows in it a clot, separated from the tube wall by numerous cells which look like those of trophoblast. At certain points are several large lumps of syncytium; also a considerable amount of nuclear dust, which seems to have arisen from the syncytium. No definite villi were found in the sections, although they appeared to be present when the gross specimen was first examined. The folds are largely free and from their bottoms proceed numerous outpocketings, which grow into the muscular wall. On the left side sections were taken through the uterine end of the tube and through the vesicle near the fimbriated end. The folds of the lumen at the uterine end are very pronounced, often running out into processes, and at the muscular border are several small outpocketings. Outpocketings are also seen on the muscular wall adjacent to the distended portion.

## No. 900g.

(Dr. R. W. Hammack, Manila, Philippine Islands.)

Tubal mass,  $33 \times 21 \times 18$  mm. A Caucasian, age 22, born in the Orient; married in 1912, one previous preg-

nancy. There is an indefinite history of an abortion on September 18, 1912. The last normal menstruation period began May 2, 1913, and there was a slight flow on June 19. Operation in July 1913. Smear preparations were made from the cervix, but no gonococci could be found. At the time of the operation the tube was found ruptured and there were numerous adhesions to the pelvic organs. The left ovary was cystic, measuring 40 mm. in diameter. The right ovary and tube appeared to be normal. The uterus was slightly enlarged. No embryo was found at the time. The specimen consists of the left Fallopian tube and ovary. The tube, which is in a fragmentary condition, has been ruptured and also freely opened. The ovary, which now measures  $33 \times 18 \times 21$  mm., is occupied chiefly by a large cyst, the wall of which consists entirely of lutein tissue, somewhat over 2 mm. in thickness. Sections were cut through the middle of the rupture and through the uterine end of the tube. The lumen of the uterine end is normal in form and has several outpocketings. There are also signs of inflammation. The section from the rupture shows that the folds of the tube are largely necrotic and infiltrated with round cells. The tips of the folds are disintegrating. Within the lumen is a small mass of fibrinous exudate. There are also several outpocketings in the muscular wall. No trace of an ovum was found.

## No. 900j.

(Dr. R. W. Hammack, Manila, Philippine Islands.)

Tubal mass,  $60 \times 50 \times 40$  mm. From a Malay woman, aged 25, who had given birth to 3 children but had had no abortions. The last menstrual period took place October 25, and after its termination began again on the 29th, continuing until the operation, which took place December 14, 1913. At the time of the operation it was found that the right tube presented two swellings, each containing a clot of blood. The cavity was found practically filled with fluid and clotted blood. The specimen consists of the right Fallopian tube and ovary, the tube being in a fragmentary condition owing to an extensive dissection, but clots are here and there present and also what is apparently chorionic tissue. A section was cut through one of the larger blocks of tissue; it includes the uterine end of the tube as well as the blood clot within the opening of the rupture. The lumen of the uterine end of the tube is packed with a mass of tissue formed by many adhesions of the folds of the tube; numerous outpocketings reach far into the muscular layer. This is evidently a case of follicular salpingitis with many outpocketings. At the point of rupture the form of the folds of the tube appear to be quite normal and no pronounced pockets can be seen, but at some points there is inflammation. The clot appears to be old and quite irregular in form; and it contains a few villi of the chorion in the last stage of degeneration. At one point there is a considerable mass of trophoblast cells.

## No. 904.

(Dr. George Stickney, Baltimore, Maryland.)

Unruptured tube,  $70 \times 55 \times 40$  mm. Embryonic remnant 1 mm. long. The specimen was sent to the laboratory perfectly fresh and placed immediately in Bouin's solution, after which it was transferred to alcohol. Later it was cut into blocks and sections were taken through the uterine end of the tube and through the middle of the enlargement, which struck the cavity of the chorion. The diameter of the chorionic cavity is about 10 mm. The tube is filled with a mottled mass, portions of which are opaque. These are composed of organized blood, but there



is also a considerable amount of fresh blood. The uterine end of the tube seems to have a normal lumen, but the muscular coat is unusually pronounced. The distended tube contains numerous pockets around its circumference, which have been formed by adhesions between the different folds. The wall has been also somewhat invaded by active trophoblast. The chorion and its villi are largely necrotic and the villi at some points are being invaded by their own trophoblast. The chorionic wall is undergoing acute degeneration and at some points there are indications of an adherent amnion. Hanging in the amniotic cavity is a small process, about 1 mm. long and 0.5 mm. in diameter. This contains a small vesicle and represents in all probability the degenerated cord of the embryo. Otherwise there is no remnant of an embryo. Sections stained with iron hematoxylin show the stratification of the fibrin unstained as in a fresh blood clot. Most of the red blood corpuscles remain unstained, which shows that, as the ovum was strangulated, there was a gradual addition of fresh blood, which made the tumor larger and larger. The fibrin bands which permeate the clot often avoid individual villi, indicating that they have a tendency to prevent coagulation.

## No. 908.

(Dr. Paul Wegfarth, Baltimore, Maryland.)

Both tubes and a clot measuring  $60 \times 50 \times 35$  mm. Our records state that the specimen is from an operation by Dr. Cullen and was brought into the laboratory by Dr. Leonard. There is some correspondence regarding it with Dr. Wegfarth, who was then one of the resident physicians of the Church Home. The specimen consists of both tubes, one ovary, in which there are two corpora lutea, and the large clot containing remnants of the villi; also a cavity, which appears to be that of the amnion. The small tube appears to be normal and the large tube is hemorrhagic and unruptured. As the fimbriated end is greatly distended, undoubtedly the clot was aborted from it. The clot is of a uniform consistency and has leucocytes scattered through it. At some points they have accumulated in large masses in the neighborhood of fibrous villi, which are found scattered through it.

A section through the wall of the cavity with the clot shows that it is composed of an atrophic chorion with degenerated villi attached to it. No embryo is found. The uterine end of the larger tube shows active inflammation in its hypertrophic folds and also an exudate, but the folds are not adherent. Around the distended portion of the tube are numerous pockets, but the tips of the folds are not adherent, although very edematous. The uterine end of the small tube has in it very hypertrophic folds and similar outpocketings, showing that this process, which causes the arrest of the ovum, was no doubt present in the uterine end of the pregnant tube.

## No. 910.

(Dr. G. L. Hunner, Baltimore, Maryland.)

Unruptured tube, 24 mm. in diameter. From a white woman, 39 years old, this being her sixth pregnancy; four of the previous five having been normal. In the fifth she miscarried at 6 weeks. The last menstrual period began May 9, 1914, and the operation took place on June 10. There was no indication of infection. At the time of the operation it was found that she had chronic pelvic inflammatory disease and there was distention of the left tube, which was also tied down by adhesions. The specimen was brought to the laboratory and fixed in Carnoy's fluid by Dr. Sabin. The specimen is a tube distended by a

spherical mass, 24 mm. in diameter, which consists chiefly of organized clot. A cross-section of the mass shows an irregular chorionic lumen, about 7 mm. in diameter, surrounded by firm, bloody walls. The chorion is filled with a dense "magma" and no remnants of an embryo can be seen.

Sections were made through three portions of the tube. Those through the uterine end show marked outpocketings from the lumen, there being six in each section. The free end of the tube is filled with hypertrophic folds, which almost completely obliterate the tube lumen. Possibly there are also some outpocketings. Sections through the distended portion pass through the chorionic cavity, which is 7 mm. in diameter. It shows the usual picture of destruction of the villi and the invasion of leucocytes in large masses forming small abscesses; there is some active trophoblast at its periphery, also much fibrinoid substance. Practically the entire muscular wall has been destroyed by the trophoblast and clot within.

## No. 911.

(Dr. Wegfarth, Baltimore, Maryland.)

Unruptured tube,  $65 \times 33$  mm., brought to the laboratory perfectly fresh and was fixed in Bouin's fluid by Dr. Evans. The specimen consists of the right Fallopian tube, and the ovary of the same side, approximately 20 mm. in diameter. The tube is covered with a rather rough but unbroken peritoneum. Cross-sections show a sausage-shaped blood-clot about 17 mm. in diameter, in which are apparently large, feeble chorionic vestiges. Sections through the uterine end of the tube show a single lumen into which project several small folds. Apparently it is normal. Sections through the distended portion show that the entire tube contains a large clot. Within are embedded numerous necrotic villi. Aside from a slight infiltration with leucocytes the tube wall appears to be normal.

## No. 919.

(Dr. V. N. Leonard, Baltimore, Maryland.)

Tubal mass,  $65 \times 40 \times 25$  mm. The specimen consists of an unruptured tube, one ovary, and a piece of the uterus. Sections were cut through the middle of the tubal mass. The wall was markedly inflamed and a similar condition prevailed in the folds, which were very edematous and infiltrated. In the tube wall were certain outpocketings, also an extensive formation of fibrinoid substance. Within was a circumscribed mass composed largely of fibrous villi and necrotic trophoblast, in the center of which was a mass composed largely of hyaline degeneration and a marked infiltration with polymorphonuclear leucocytes. At one point these were so numerous as to form a large abscess. The specimen came from a colored woman, 28 years old, who had been married 4 weeks. She is the mother of one child, 10 years old. Her last period began on January 3, 1914, and the operation was performed on April 27. She had been bleeding 3 weeks before the operation. At the time of the operation the pelvis was found filled with clotted blood.

## No. 927.

(Dr. Leon H. Watkins, Baltimore, Maryland.)

Unruptured tubal mass,  $50 \times 20 \times 20$  mm. The patient, a well-nourished colored woman (age unknown), had had one child and no miscarriages. The last menstrual period had occurred July 7, 1914, the one preceding having been in April. At the hospital a diagnosis of extra-uterine pregnancy and chronic appendicitis was made. The uterus

was enlarged and in the left side could be felt a movable mass somewhat larger than the left ovary and separate from it. The right side seemed clear. At the operation, on July 13, the mass in the left side was found to be an extra-uterine pregnancy, about 3 cm. in diameter, in the middle portion of the left tube. The uterine portion of the tube was removed. The right tube and ovary were normal.

The specimen consists of the left Fallopian tube, which forms an S-shaped spiral. At the uterine end the specimen undergoes an egg-shaped dilatation, becoming about 20 mm. in diameter. From the segment of the tube next adjoining this, projects a tumor-like swelling,  $25 \times 15 \times 15$  mm., over the surface of which chorionic villi may be seen exposed in some places. Sections through the swelling of the uterine end show the tube with its periphery infiltrated with blood. A slit-like chorionic cavity,  $6 \times 2$  mm. is found near the beginning of the dilatation.

Sections were taken through the uterine end of the tube, through the middle of the swelling, and the fimbriated end, which contains a very small opening. The folds in the uterine end of the tube are unusually well pronounced; none of them are adherent. At the fimbriated end the lumen is almost closed and is lined with two concentric layers of mucous membrane with numerous epithelial pockets between them. The condition of the mucous membrane in the uterine and fimbriated ends of the tube appears to be the reverse of what is usually found in these cases, but careful inspection proves definitely that the two ends were not mixed at the time the sections were taken. Sections through the middle of the tube struck the point of implantation, which seems to encircle the entire wall, and not the faintest trace of the tube lumen can be made out. The blood within the tube lumen is mostly fresh and partly organized; within are seen many villi and the collapsed ovum. Some of the villi are necrotic and some of them have undergone fibrous degeneration. The tube wall has been invaded at its largest diameter by very active trophoblast. No trace of an embryo is found.

## No. 928.

(Dr. W. Morriss, Baltimore, Maryland.)

Unruptured tube,  $75 \times 28 \times 28$  mm. The history of this case is somewhat meager. The patient was 20 years old. There were pelvic symptoms three weeks before the operation. The last period is said to have begun 6 days before the operation and appeared to be normal. At the time of operation no adhesions were found, but there was a retroflexion of the uterus.

This fine specimen measures 75 mm. in length. Near its fimbriated extremity the tube has swelled into an egg-shaped dilatation, 28 mm. in circumference and about 28 mm. in length. The end of the tube has three distinct fimbriated areas, the largest of which measures  $24 \times 15$  mm., the second  $8 \times 7$  mm., and the third  $14 \times 6$  mm. The free-hand section shows that the tube is occupied by a firm hemorrhagic nodule which separates itself easily from the tube wall. Sections through the tube at the uterine end show that the form is normal, but the surrounding tissue is somewhat infiltrated with round cells. The second block, which was cut at a point about 1 cm. from the first near the point of distention, shows large and acutely inflamed folds, more or less adherent, owing to the presence of an inflammatory exudate. Sections through the fimbriated end show that the folds are edematous, but normal in form and not adherent. There are several small outpocketings in the muscular wall. Sections through the distended portion passed through the point of implanta-

tion, leaving a crescent-shaped slit, encircling the blood clot one-half way around the tube. Into this project a few villi, apparently normal. The blood clot is largely fresh, partly organized, and permeated by strands and colonies of leucocytes. The villi are mostly necrotic and many of them have been invaded by leucocytes. Where the trophoblast comes in contact with fresh blood it is vacuolated and active.

## No. 932.

(Dr. R. W. Hammack, Manila, Philippine Islands.)

Unruptured tube,  $40 \times 30 \times 25$  mm. From a Malay woman, 20 years old, who had been married a short time before the operation, this being her first pregnancy. On March 30, 1914, she had had bleeding for one day. The last menstrual period had occurred on April 6, 1914. The operation was performed on May 19. There was no history of infection nor of any discharge from the uterus. At the time of the operation large irregular blood clots were found encircling the tube. The specimen consists of many large blood clots and a portion of the right Fallopian tube and ovary. A slab shows that the tube is occupied by a hemorrhagic chorion. A section through the ovary shows a beautiful convoluted corpus luteum, measuring  $17 \times 10$  mm.

Sections through the uterine end of the tube show that it is filled with large folds, which are for the most part adherent, and form numerous pockets within the tube lumen. There are also several deep pockets which reach far into the muscular layer. Sections through the distended portion take in the point of implantation as well as the crescent-shaped tube lumen on the opposite side. The folds of the tube lumen are insignificant and there are no outpocketings. The tube lumen is composed of much fibrinoid substance, together with leucocytes, organized and fresh blood clot, as well as many villi, which are capped by necrotic masses of trophoblast. A section, which passed through the main chorionic wall, shows that it is entirely collapsed.

## No. 934.

(Dr. V. N. Leonard, Baltimore, Maryland.)

Pathological embryo, 6 mm. long. From a negro woman, aged 35, who had been married 10 years. She was the mother of 3 children, the oldest 10 years old and



FIG. 24.—Pathological embryo from specimen No. 934.  $\times 8$ .

the youngest 5. Her last period had begun July 21, 1914, previous periods having been irregular. The operation was performed August 10. The patient was probably suffering from chronic gonorrhea, and at the time of the operation numerous adhesions were encountered. The fresh specimen was placed in Brouin's fluid. After it was partly fixed it was cut into slabs with a razor. The specimen consists of a Fallopian tube, 92 mm. long, and an ovary, 32×20 mm. The tube is swollen, forming two large irregularly spherical masses, which adjoin the outer and inner (uterine) ends respectively, and measure 50×55×40 mm. and 50×32×36 mm. When the mass at the isthmus end is cut open, a firm, bloody, chorionic mass with a lumen, 21×12 mm., is seen. The chorionic cavity has smooth walls and contains an adherent young monstrosus embryo with a greatest length of about 6 mm. This is best described as an opaque white mass, in which head and body are barely distinguished as nodules. Between the two tubal swellings and lying directly over the ovary are numerous greatly hypertrophied folds of musoca. This fimbriated area extends in an irregular sickle-shaped area, 38×13 mm.

A section through the largest part of the tube, which strikes the middle part of the chorionic cavity, shows that the ovum is surrounded by mottled blood clots, some organized, others fresh. The chorionic wall is fibrous, and the villi are fibrous and atrophic. The muscular wall of the tube is markedly inflamed and closely adherent to the inclosed clot. There are also several outpocketings in the muscular wall from the epithelial lining of the tube. The embryo, which looks like a grain of wheat, was cut into serial sections, but only the central nervous system can be recognized in them. The rest of the viscera are completely dissociated; none of them can be located with certainty. The enveloping sheath, that is, the skin, is markedly hypertrophied, showing that this portion of the embryo was growing while the rest was undergoing destruction.

## No. 938.

(Dr. Gilbert M. Elliot, Brunswick, Maine.)

Ruptured tube, 45×20×20 mm. From a French-Canadian woman, married June 30, 1914, this being her first pregnancy. Her last period began on June 16 and the operation was performed on August 16, on account of a sudden collapse, probably due to the rupture of the tube. The patient had been very healthy and there were no indications of venereal disease. Aside from the tubal infection, the rest of the organs appeared normal at the time of the operation. The specimen consists of a Fallopian tube, about 45 mm. in length, and distended near the uterine end by a spherical enlargement, 20 mm. in diameter, which has ruptured spontaneously, the fissure being about 16 mm. in length. The mass, when cut into slabs, shows the chorion densely infiltrated with blood. In its middle portion is an irregular chorionic cavity, 7 mm. in diameter, near which the blood is bright red. In the fimbriated extremity of the tube, which is extensive, the ovary, measuring 30×17×15 mm., has been implanted. A well-developed corpus luteum can not be found, but a small, dense yellow body, about 4 mm. long, is seen at one pole.

Sections from the uterine and fimbriated ends of the tube appear to be quite normal; the folds are not excessive nor adherent. There are no outpocketings. There is a slight exudate within the tube lumen. Sections through the distended portion do not include the wall of the chorion. The clot is well organized and ramified with strands of leucocytes and a few necrotic and degenerate villi. At some

points the leucocytes are so numerous as to form small abscesses. The tube lumen, which is very small, is almost entirely denuded of its epithelial layer. Aside from the pregnancy the tissue seems to be normal throughout.

## No. 939.

(Dr. W. G. Sexton, Baltimore, Maryland.)

Unruptured tube, 75×25×20 mm. From a Hebrew woman, 36 years old, who was the mother of 3 children and had had no previous abortions. The last menstrual period occurred 4½ months before the operation, which took place on August 17, 1914. There was no history of venereal disease, but at the time of the operation adhesions were found around both tubes. The specimen consists of two Fallopian tubes. The larger (the right) measures 75 mm. in length and is distended by two enlargements about 20 mm. in diameter and 25 mm. in length. Sections through the distended portion nearest the fimbriated extremity show an enormous hypertrophy of the tubal mucosa, the tube lumen measuring 13 mm. This is also true for the other enlargement in its outer half; but in sections through the inner half the walls are more fibrous in character and inclose on one side a blood clot, 3 mm. in diameter. The other tube measures 56 mm. in length and shows three enlarged portions, the outermost enlargement which adjoins the fimbriated extremity, is 14 mm. in diameter and about 18 mm. long. It shows an extensive lumen, completely occupied by folds of mucosa. The second enlargement, which adjoins the first, is about 11 mm. in diameter. A section shows that some change has taken place in the tube. The third enlarged portion, which is smaller, measures 9 mm.

Sections through the uterine and fimbriated ends of the pregnant tube seem to be quite normal as to form, but there is a marked inflammation. The clot, encircling a few villi present within it, lies in a pocket away from the main tube lumen, and in this pocket, which is entirely surrounded by mucous membrane, is a very pronounced peripheral follicular salpingitis. The main part of the lumen, like the rest of tube, is normal as to form. The tube from the opposite side shows in its course three distinct enlargements, the whole tube measuring 56×15×12 mm. Sections were cut through these enlargements in four portions of the tube and it was found that in general the form of the folds is normal, although a considerable amount of inflammatory reaction is present. The uterine end of the tube appears very much like the corresponding end of the opposite side, with the possible difference that it is somewhat more inflamed. The sections through the fimbriated end are much like those from the other side, with the possible exception that there are some outpocketings in the thickened folds as well as in the muscular wall of the tube. The distended portion within the fimbriated end is markedly inflamed and some of the folds here are adherent—that is, there is a beginning follicular salpingitis. The enlargement near the uterine end shows a more pronounced follicular salpingitis. The case is especially valuable, as it shows the diseased condition in the tube opposite the one which is pregnant, whereas that in which the pregnancy is located has a large diverticulum off the lumen of the main tube.

## No. 945.

(Dr. G. E. Crawford, Cedar Rapids, Iowa.)

Normal embryo, CR 37.5 mm. From a German woman, aged 37, married in 1899. She was the mother of three children and had had one abortion in 1904 at 2 months.

Her last period began on July 16, 1914, and she was operated upon on September 29. Otherwise the history contains nothing of importance. We received only the embryo, and therefore could make no examination of the tube wall.

## No. 953.

(Dr. M. Y. Dabney, Cleveland, Ohio.)

Ruptured tubal pregnancy,  $35 \times 20 \times 20$  mm. The tube was moderately distended and sections were taken through three portions of the wall. The folds of the mucous membrane of the uterine and fimbriated ends were normal in form, but were somewhat infiltrated with leucocytes. No outpocketings nor adhesions could be detected. Sections through the distention showed that it was composed of mottled blood with the fresher corpuscles taking on iron hematoxylin stain; the rest failing to do so. Scattered through the clot were a few fibrous villi, in the last stages of disintegration, being outlined mainly by an accumulation of leucocytes. Sections struck the point of implantation, where the tube wall was quite inflamed. The crescent-shaped lumen which surrounded the clot had hanging into it a few atrophic folds; otherwise it was lined with a single layer of epithelium.

## No. 967a.

(Dr. R. W. Hammack, Manila, Philippine Islands.)

Unruptured mass,  $50 \times 40 \times 30$  mm. From a Malay woman, 27 years of age, who had been married 10 years and was the mother of two children; there was no history of previous abortions. The last period began on April 20, 1914, and lasted for 10 days; after this there was irregular bleeding until the operation, which took place May 19, 1914. She had had a uterine discharge since 1906 and her husband was suffering from gonorrhea. The specimen consists of a piece of tube, a distended portion which has been cut into, and numerous large blood clots. No embryo is found. Sections through the uterine end of the tube show that it is quite normal in form. A section made from the distal side of the distended portion shows the tube to be filled with very large folds and at the periphery is a pronounced follicular salpingitis with pockets forming between the tube folds, which are filled with numerous epithelial-like cells. The wall of the distended portion is very thick and composed of mottled blood, in which are numerous necrotic and fibrous villi. Large masses of nuclear dust often accompany the necrotic villi. Sections stained with iron hematoxylin show that only the fresh blood masses take on the fresh stain.

## No. 967b.

(Dr. R. W. Hammack, Manila, Philippine Islands.)

Unruptured tubal mass,  $60 \times 35 \times 30$  mm. The patient was a Malay woman, 33 years old, the mother of two children; there was no history of abortion. The last period began the last part of May, and was followed by profuse hemorrhage, which was more or less continuous until the time of the operation, August 1. At the operation the unruptured tube was found to be bound down with adhesions. The tubal mass is considerably contorted and measures  $60 \times 35 \times 30$  mm. (It had been opened before it was sent to us.) It contains a blood clot  $25 \times 15 \times 15$  mm. but no embryo is to be found. The mucous membrane of the tube wall is markedly inflamed and surrounded by an extensive follicular salpingitis. It has been invaded by several outpocketings. The tissue of the folds has been almost entirely destroyed by numerous leucocytes which

have invaded it. The cavities of the spaces are filled with exfoliated epithelial cells. The blood clot within is of uniform density, and on one side of it is a necrotic ovum with many attached villi.

## No. 967c.

(Dr. R. W. Hammack, Manila, Philippine Islands.)

Tubal mass,  $65 \times 50 \times 30$  mm. The patient was a Malay woman, 40 years of age, who had been married for 20 years. She had been pregnant three times, with no abortions. The last period took place in March 1914, after which there was continuous bleeding for about a month before the operation (June 18, 1914). There was no discharge from the uterus. At the operation it was found that the uterus was bound down by adhesions. The specimen consists of a tubal mass,  $65 \times 50 \times 30$  mm. Its distal end contains the cavity,  $20 \times 15$  mm. In addition there are four other masses, together weighing about 80 grams. No embryo is to be found.

Sections through the uterine end of the tube show that the folds are markedly hypertrophied and from them extend numerous villus-like processes. There are also several outpocketings. The mucous membrane is edematous and somewhat infiltrated with leucocytes. The section through the cavity into the specimen is lined with a very thick layer of fibrinoid substance, and some of the large sinuses within the muscular wall have in them trophoblast cells. The section also strikes a portion of the tube lumen which is marked by pronounced follicular salpingitis as well as outpocketings. Although no trace of an embryo was found in the sections, I am inclined to believe that a normal embryo had been present and was peeled out entirely at the time of the operation. The extensive amount of fibrinoid substance and the pronounced trophoblast cells within the venous sinuses support this idea.

## No. 974.

(Dr. A. W. Elting, Albany, New York.)

Unruptured tube,  $40 \times 20 \times 20$  mm. From a patient 34 years of age, who had been married 11 years. She began to menstruate at the age of 16 and had always been regular. A few months after her marriage she had her first abortion, which was an artificial one. She stated that since that time she had had nine or ten pregnancies, some of which aborted spontaneously, others being artificially induced. She had had only one child, at full term, now 13 months old. Menstruation was regular after the last childbirth. The last menstruation began October 3, 1914, was normal, and lasted 3 days. On October 16 she had severe pain in the abdomen, chiefly on the left side, with nausea and vomiting and a slight flow. The pain continued with more or less nausea and slight flowing until she was operated upon on October 22. At the operation evidences of an attempted tubal abortion were found. There was considerable amount of blood in the abdominal cavity, but no evidence of actual rupture of the sac or of an extrusion of the fetus.

The specimen consists of an unruptured tube measuring  $40 \times 20 \times 20$  mm., to which is attached an ovary, containing a cyst, 35 mm. in diameter. A section of the tube shows that it is filled with blood of a uniform black hue. The clot protrudes through the fimbriated opening. Sections through the uterine end of the tube show small folds, slightly inflamed, with several very small outpocketings. The distended portion of the tube has a very thin muscular wall with scattered folds, many of which are adherent. There

are no outpocketings. The tube wall is markedly inflamed. The clot within is quite uniform, consisting of concentric rings of fibrous tissue, on the periphery of which are embedded a few small necrotic villi, most of them having been invaded by leucocytes.

## No. 977.

(Dr. G. N. J. Sommer, Trenton, New Jersey.)

Partly ruptured tube,  $45 \times 25 \times 20$  mm. From a woman 27 years of age, who had been married 4 years, this being her first pregnancy. After the period beginning September 3, 1914, the next period, on October 17, was accompanied by pain in the left side. Bleeding continued off and on until the time of the operation, November 4, 1914. She had three attacks of pain at intervals of 6 days. The left tube was removed at the operation and found to be ruptured about its middle. There was no evidence of pelvic inflammation. The right tube and ovary were normal; the uterus was somewhat enlarged and soft; there were no signs of leucorrhea or venereal disease. The members of the mother's family had been fertile.

The specimen is a tube, measuring  $45 \times 25 \times 20$  mm., which came to us partly ruptured and distended at several points. At one point there is a rupture about 5 mm. in diameter, through which protrude numerous white villi. A section through this portion shows that the ovum is directed towards it, most of the villi having accumulated under the point of rupture. More towards the center of the tube is a cavity which contains a granular mass, probably the disintegrated embryo within the cavity of the chorion.

Sections through the uterine end of the tube show that it is filled with numerous very large folds, many of which are adherent to one another; but there are several small outpocketings in the muscular layer. The section through the fimbriated end of the tube is quite similar to that through the uterine end. The wall of the tube near the rupture is markedly infiltrated with trophoblast on one side. Within are numerous villi which, although somewhat fibrous, are quite normal in appearance. They are covered with a large amount of trophoblast, which would seem to indicate that the embryo had been normal a short time before the rupture. The clot is somewhat permeated with bands of fibrin and the delicate folds of the tube are all independent. Most of the villi have blood within them, showing blood-corpuscles of the embryo.

## No. 990.

(Dr. G. L. Hunner, Baltimore, Maryland.)

Unruptured tube,  $64 \times 37 \times 33$  mm. From a white woman who has been married 8 years, this being her first pregnancy. The last period began on October 30 at the regular time and continued until the time of operation, November 23. She has been suffering from pain in the pelvic region for the past month, with occasional severe pains in the abdomen, accompanied with great difficulty in breathing. There is no evidence of venereal disease.

At the time of operation the uterus was found to be normal and well embedded in large blood clots, over a pint of blood and serum being removed. There were old adhesions about the right tube and both ovaries. The left tube contained the pregnancy. Both ovaries were cystic and degenerated; the corpus luteum of pregnancy could not be found.

Sections through the uterine end of the tube show the folds greatly enlarged with epithelial pockets growing into them as well as into the tube wall. Some of these pockets

are unusually large, measuring about 1 mm. in diameter. The clot is mottled and contains an ovum which is partly collapsed and filled with fresh blood. There are several very large accumulations of leucocytes in this specimen, many necrotic and a few fibrous ones. A section strikes the point of implantation, which is relatively small, the crescent-shaped tube lumen being lined with a few small folds, which are almost filled with leucocytes. Another section through the blood clot, but nearer the fimbriated end, gives the same picture.

## No. 992.

(Dr. Edward J. O'Brien, Detroit, Michigan.)

Ruptured tube,  $51 \times 42 \times 36$  mm., with an embryonic mass 2 mm. long. From a woman who first married 5 years ago. She had a miscarriage at 7 months which was followed by pneumonia, which kept her in bed 4 weeks. The menses have always been normal. There is no history of excessive leucorrhea. She is strong and well nourished. A year ago she married a second time and menstruation was regular until 3 weeks before operation. This period lasted 3 days longer than usual and was very profuse and painful. Examination showed marked tenderness on the right side and a mass to the right of the uterus. The uterus was not perceptibly enlarged.

The specimen consists of an irregularly compressed tube, which has been ruptured or cut open, and shows a cavity lined with a smooth membrane, measuring 20 mm. in diameter. No embryo was found. Sections through the uterine end of the tube show a lumen quite large and filled with hypertrophied folds, which form large pockets ramifying clear across the tube lumen. There are also very pronounced pockets at the bottoms of the folds—that is, there is a pronounced follicular salpingitis with the usual villus-like processes extending into the follicles. A section through the hemorrhage did not include the tube wall. It is mottled with blood, which is partly organized and partly fresh. The latter takes on an intense stain with iron hematoxylin. The chorionic wall is not much altered and is lined with a very thin amnion. The section passes through the cord, the free end of which is partly round, but at one place it runs out into a sharp point. The cord, which is about 2 mm. long, contains the remnants of its blood vessels and a rounded tube, which strongly suggests the allantoid. The hemorrhagic mass is permeated with numerous villi, most of which are fibrous and many of them necrotic. The trophoblast is not very active and at some points there are necrotic masses of trophoblast, showing that the ovum was strangulated some time before the operation.

## No. 995.

(Dr. Guy L. Hunner, Baltimore, Maryland.)

Unruptured tubal mass,  $85 \times 65 \times 40$  mm. From a white woman 38 years old, this being her fifth pregnancy, she having given birth to three children and having had one other abortion. The last period began September 28, 1914, and on October 8 bleeding began and continued until November 26, when the operation was performed. There was no evidence of venereal disease. She came from a very fertile family, being one of 13 children and one of 144 grandchildren and great-grandchildren. At the time of the operation the uterus was somewhat enlarged. The right tube and ovary, although normal, were bound down by adhesions.

The specimen consists of a well-organized clot, the measurements of the tubal mass being given above. Sections were taken through the clot as well as through the

uterine end of the tube. The latter shows a pronounced follicular salpingitis with an extensive infiltration of leucocytes. Most of the folds of the tube are adherent and the network formed by them is so extensive that at some points they appear to be in the tube lumen.

Sections through the point of greatest distention show that the clot is not adherent at any place. The lumen of the tube is lined with folds, which are markedly inflamed, but otherwise perfectly normal. There are no outpocketings or any indication of follicular salpingitis. Within the blood clot, which is composed mostly of fresh blood, is a large collapsed ovum. The chorionic wall and the villi are fibrous and atrophic. Some of the villi are undergoing necrosis, and these necrotic masses have been invaded by a large number of leucocytes. Radiating from the tip of the villi and other points are strands of fibrin and leucocytes, which form the characteristic stratification so often seen in these specimens.

No. 998.

(Dr. W. H. Donaldson, Fairfield, Connecticut.)

Tubal mass,  $85 \times 45 \times 45$  mm. From a Hungarian woman 28 years old, who had been married 9 years, this being her first pregnancy. The last period began Sep-

tember 28, 1914, and continued for 4 days. The operation was performed November 24. The left tube appeared to be normal and the uterus was enlarged to twice its normal size. The pregnancy was in the left tube. Venereal disease was denied. The specimen consists of a tubal mass,  $85 \times 45 \times 45$  mm., which has been cut open, exposing a cavity  $20 \times 15$  mm. The cavity is lined with a smooth, glistening membrane. No embryo is found, but her physician states that at the time of the operation a beautiful embryo was seen when the tube was opened.

The section through the uterine end of the tube shows a pronounced follicular salpingitis. The tube is cut up by fibrous anastomosing bands, the follicles being filled with processes, some of which also anastomose. The section could almost pass for that of an organ. A section through the hemorrhagic mass includes also the tube wall. It is composed of mottled blood, containing many necrotic and fibrous villi. In the neighborhood of the fresh blood some of the trophoblast is active. The chorionic wall is also fibrous and at some points the amnion can be easily seen. The tube wall is more or less adherent and is often extensively inflamed and encircles the clot. Nearly the entire mucous membrane is intact and shows an extensive follicular salpingitis.

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## EXPLANATION OF PLATES 1, 2, AND 3.

### PLATE 1.

- FIG. 1. Section through the attachment of the villi to the tube wall in No. 109, showing the extension of the trophoblast into the veins, with the destruction of their endothelial lining.  $\times 72$ .
- FIG. 2. Section through the veins in the tube wall of No. 109, showing a more extensive invasion of trophoblast than in the veins pictured in fig. 1.  $\times 100$ .
- FIG. 3. Section through an extension of vacuolated syncytium between the tips of the villi and the tube wall (No. 109). At *B. V.* a blood vessel is tapped and between it and the villus there is an extensive hemorrhage of blood into the spaces of the vacuolated syncytium.  $\times 50$ .
- FIG. 4. Syncytium covering a typical villus (No. 808). Stained with hematoxylin and aurantia. The blood corpuscles fill the spaces of the syncytium and fragments of corpuscles lie within the protoplasm of the cells. There are all gradations between complete blood corpuscles and granular protoplasm which take on the same color.  $\times 300$ .

### PLATE 2.

- FIG. 1. A villus which is undergoing fibrous degeneration (No. 694).  $\times 160$ .
- FIG. 2. Section through the last remnant of the ovum in apposition with the tube wall (No. 472). The villi have undergone extensive degeneration and the trophoblast and part of the tube wall are hyaline.  $\times 120$ .
- FIG. 3. Tip of a fibrous villus from No. 670, partly covered with trophoblast, which extends over in the adjacent clot, where it is undergoing hyaline degeneration. All stages of trophoblast undergoing hyaline degeneration are shown.  $\times 100$ .
- FIG. 4. Section through a necrotic villus of No. 575 which is covered with an irregular mass of dead epithelium. At points the nuclear mass is clumped and somewhere the necrotic mass radiates between the blood cells. There are also accumulations of leucocytes.  $\times 105$ .
- FIG. 5. Section through an island of vacuolated syncytium which is extensively infiltrated with leucocytes (No. 567).  $\times 55$ .
- FIG. 6. Specimen No. 430, showing extreme degeneration of the syncytium. The protoplasm is converted into a hyaline mass and chromatin is represented as nuclear substance.
- FIG. 7. Portion of diagram shown on page 80 (No. 670), enlarged 700 diameters. The invagination of the epithelial cells is very pronounced. There are also numerous large protoplasm cells seen in the spaces of the mesenchyme. These are the so-called Hofbauer cells.

### PLATE 3.

- FIG. 1. Section through the point of attachment between a fibrous villus and the tube wall of No. 570. The epithelial covering has been detached and the space is filled with blood.  $\times 100$ .
- FIG. 2. Section through the degenerated ovum in situ (No. 754). The coelom is filled with mottled granular magma into which there are radiating cells of mesenchyme.  $\times 85$ .



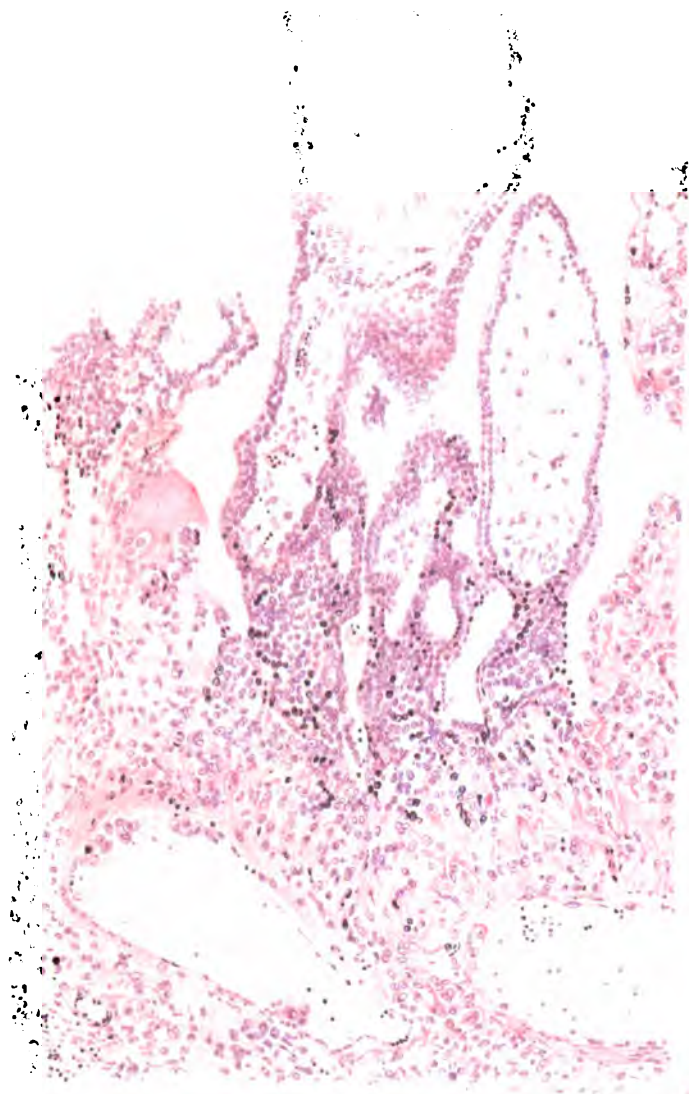


FIG. 1. (109)

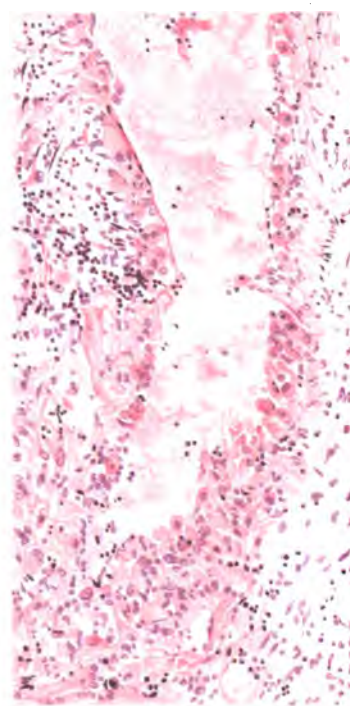


FIG. 2. (109)

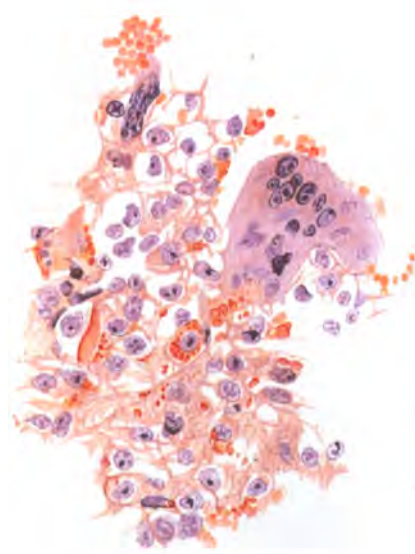


FIG. 4. (1868)



FIG. 3. (109)







FIG. 1. (694)



FIG. 2. (472)

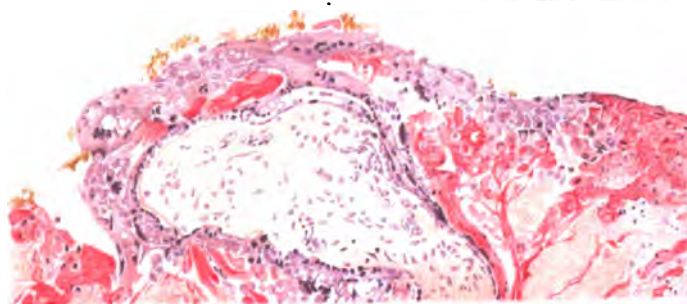


FIG. 3. (670)



FIG. 4. (676)



FIG. 5. (667)



FIG. 6. (430)



FIG. 7. (670)

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J. F. Didusch fec



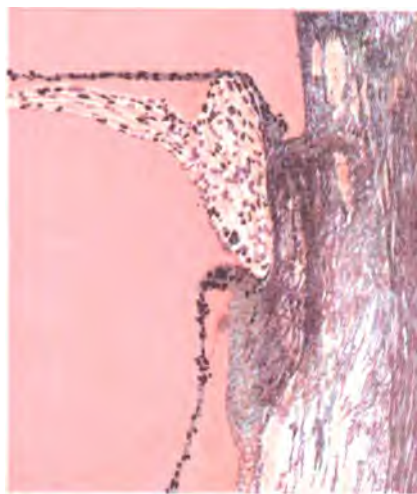


FIG. 1. (570)

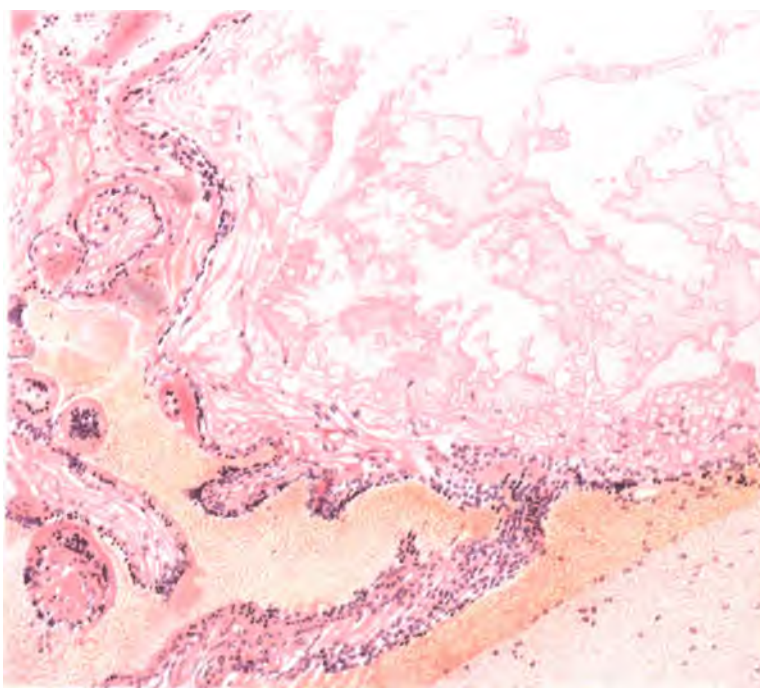


FIG. 2. (14)



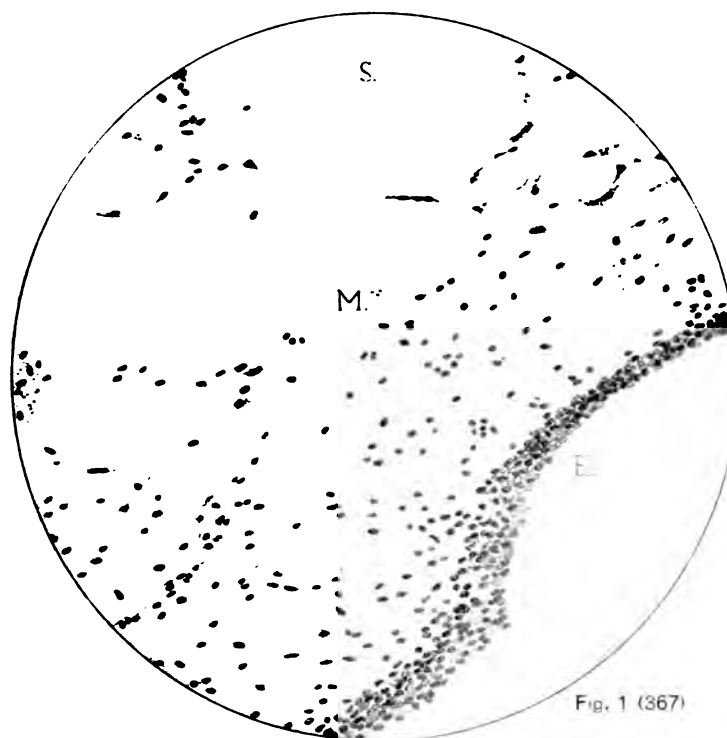


Fig. 1 (367)



Fig. 2 (367)

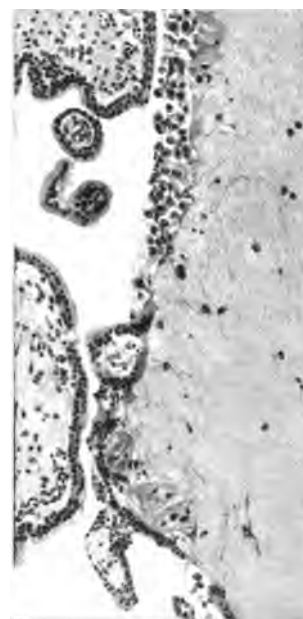


Fig. 3 (109)

J. F. DIDUSCH DEL.

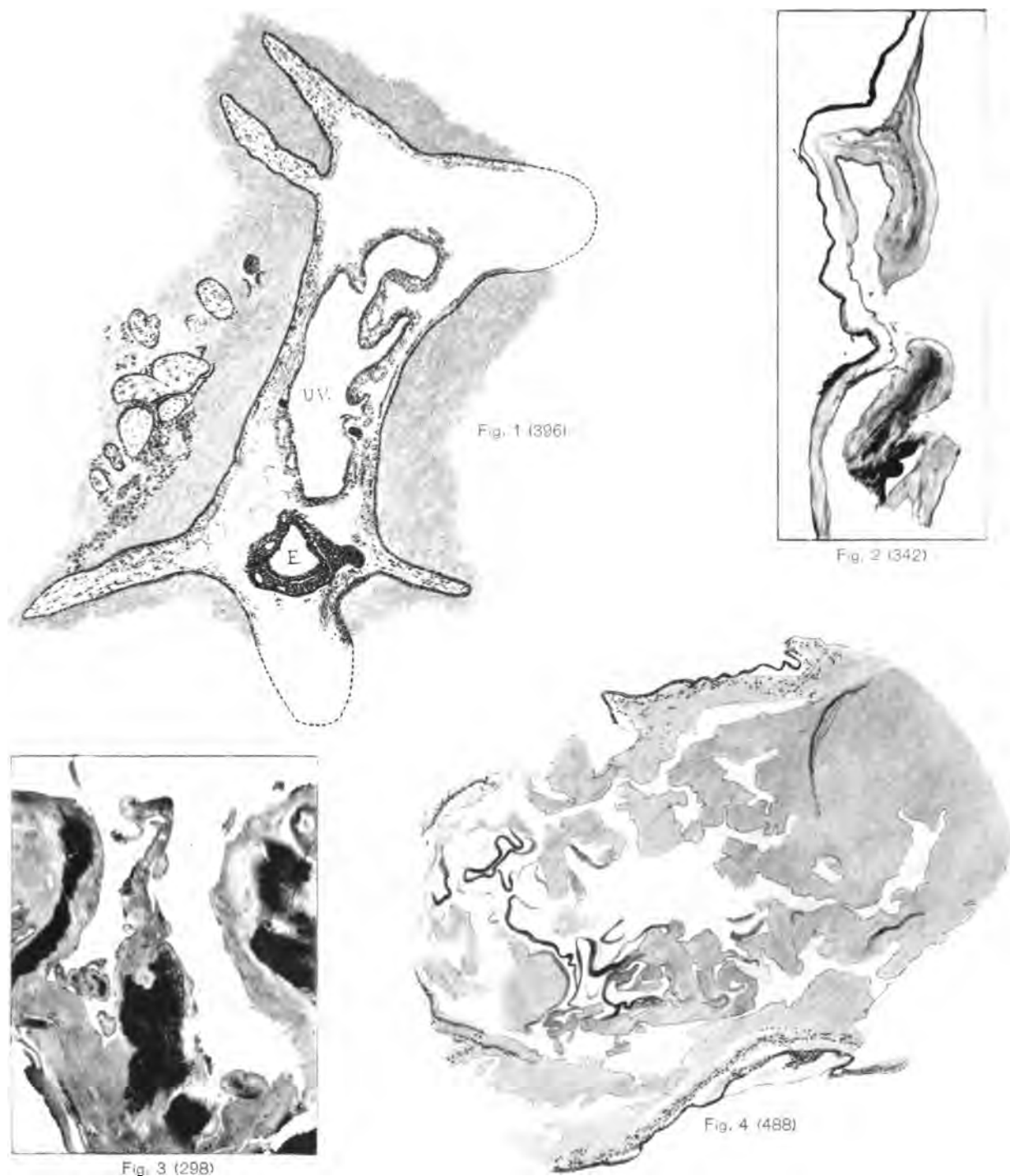
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FIG. 1. Section through a part of a large villus from No. 367 showing extensive mucoid degeneration of the mesenchyme. *E*, epithelial covering; *M*, mesenchyme; *S*, large space.

FIG. 2. Section through the ovum (No. 367) showing an extensive magma within the coelom.  $\times 75$ .

FIG. 3. Section through the periphery of a blood clot covered with wandering trophoblast cells extending from a small villus in No. 109. It may be noted that the individual trophoblast cells have invaded the clot.





**FIG. 1.** Section through the blood clot and chorion of No. 396 which contains two bodies, one probably the remnant of the embryo, *E*, and the other, *U. V.*, or the umbilical vesicle.  $\times 35$ .

**FIG. 2.** Photograph of section through the attachment of the embryonic rudiment to the chorionic wall of No. 342. The rudiment which is represented by a dense mass of cells lying within a cavity is set upon a pedicle which is probably the degenerated umbilical cord. At its attachment to the chorion there are indications of blood vessels.

**FIG. 3.** Section through the remnant of the ovum within the tube of No. 298. Only a few fibrous villi remain.

**FIG. 4.** Section through the degenerated chorion of No. 488. The wall has been somewhat injured in the manipulation required to remove it from the tube lumen. The cœlom is filled with an extensive magma in which there are numerous membrane-like bodies which may represent an embryo.  $\times 36$ .

Fig. 1 drawn by Dorothy Peters; Fig. 4 drawn by J. F. Dildus







Fig. 1 (256)



Fig. 2 (612)



Fig. 3 (495)



Fig. 4 (338)



Fig. 5 (602)

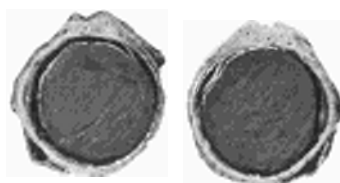


Fig. 6 (540)



Fig. 7 (519)

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- FIG. 1. Retouched photograph of embryo, No. 256. The small openings over the eyes represent the holes from which the brain has escaped.  $\times 5\frac{1}{4}$ .
- FIG. 2. Photograph of a pear-shaped tube of No. 612 showing the kink on one side and the stem which contains the Fallopian tube. Direction of the section is also shown.  $\times 1$ .
- FIG. 3. Photograph of specimen, No. 495, showing external form of the tube and direction of section through the block.
- FIG. 4. Photograph of embryo, No. 338.  $\times 2$ .
- FIG. 5. Photograph of specimen, No. 602, showing the partial rupture and the direction of the section.  $\times 1$ .
- FIG. 6. Photograph of the blocks cut from the distended tube of No. 540. On one side vascular salpingitis may be recognized between the tube wall and the clot.  $\times 1$ .
- FIG. 7. Photograph of the ovary and the tube, No. 519, showing direction of the section. There is a very large open cavity within the ovary.  $\times 1$ .





Fig. 1 (657)

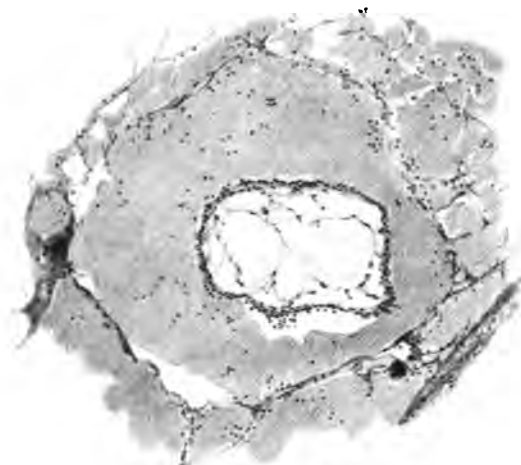


Fig. 2 (575)



Fig. 3 (575b)



Fig. 4 (657)



Fig. 5 (697)

J. F. DIDURCH DEL.

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- FIG. 1. The tube of No. 657 which has been dissected so as to show the embryo in position. The space between the amnion and the tube wall is filled with a partly organized clot. The embryo appears to be normal.  $\times 8/6$ .
- FIG. 2. Section through a degenerated villus of No. 575 lying within the blood clot. It may be noted that the fibrin of the blood clot does not touch the villus. Numerous leucocytes are also shown.  $\times 45$ .
- FIG. 3. Photograph of specimen No. 575.
- FIG. 4. Retouched photograph of a villus undergoing mucoid degeneration, No. 657. It is partly infiltrated with leucocytes.  $\times$  about 65.
- FIG. 5. Photograph of the collapsed ovum within organized clot surrounded with great masses of leucocytes (No. 697). The coelom is filled with dense magma.  $\times$  about 40.





Fig. 1 (720)



Fig. 2 (741)



Fig. 3 (741)

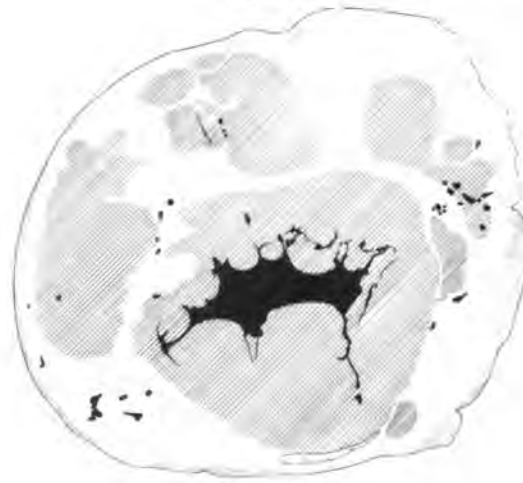


Fig. 4 (741)

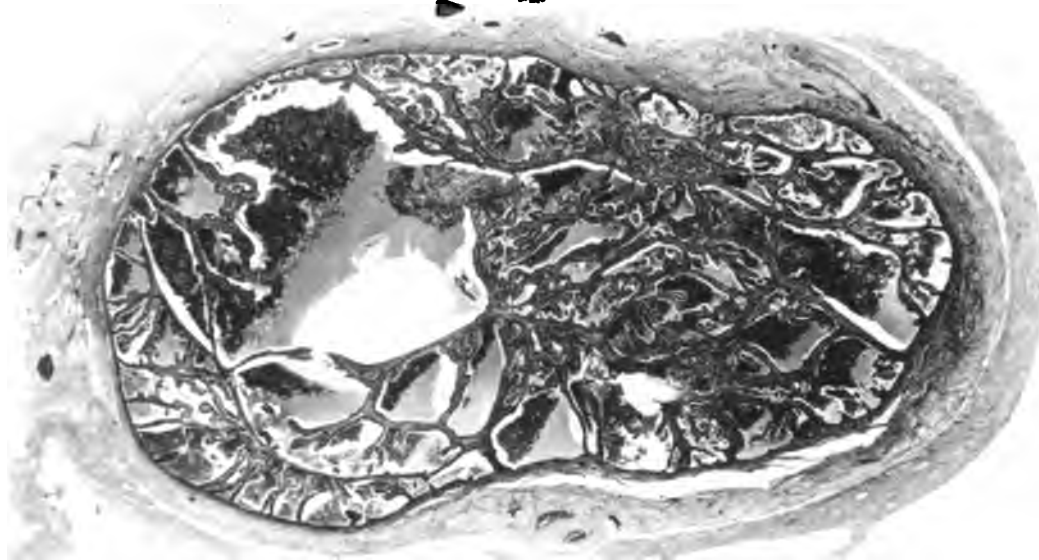


Fig. 5 (726)

J.F. DIDUSCH DEL.

CAMPSILL ART CO.

- FIG. 1. Outline of tube showing distention caused by the pregnancy (No. 720)  $\times \frac{1}{2}$ .  
 FIG. 2. Pus tube opposite the pregnancy in No. 741.  $\times \frac{1}{2}$ .  
 FIG. 3. Photograph of degenerated syncytium radiating from a tip of villus in No. 741. On either side there are large masses of leucocytes.  $\times 55$ .  
 FIG. 4. Semidiagrammatic sketch of the ovum within the tube of No. 741. The ovum and villi are drawn in black. The red blood clots are striated and the organized clot is white.  $\times 2$ .  
 FIG. 5. Photograph of transverse section of tube with extensive follicular salpingitis (No. 726).  $\times$  about 15.





Fig. 2 (734)

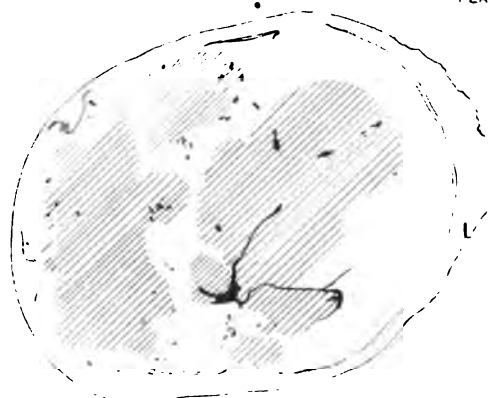


Fig. 1 (734)

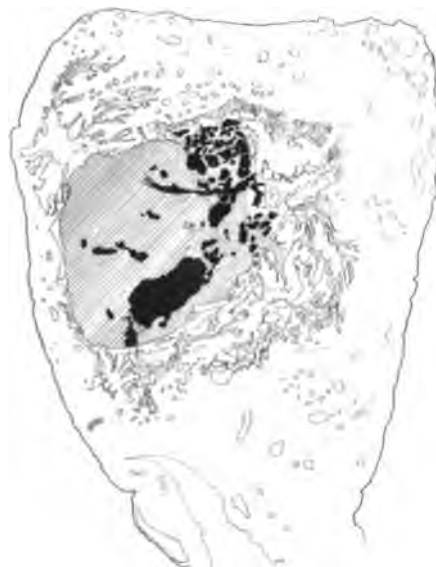


Fig. 3 (754)



Fig. 4 (825)



Fig. 5 (825)

J. F. DICUSCH DEL.

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- FIG. 1. Semidiagrammatic sketch of the collapsed ovum within the tube (No. 734). The ovum and the villi are black. The red blood is striated and the organized clot is white.  $\times 4$ .
- FIG. 2. Photograph of transverse section of the tube (No. 734), showing marked diverticula in the tube lumen.  $\times 8$ .
- FIG. 3. Outline sketch of a transverse section of an ovum lying in the outer end of the tube in No. 754. The ovum and villi are black. The red blood clot is striated. The organized clot is marked by broken lines, and the fresh blood clot is indicated by dots.  $\times 4$ .
- FIG. 4. Tube showing extensive adhesions with numerous enlarged vessels (No. 825). At one point there is an indication of rupture. Natural size.
- FIG. 5. Section through the greatest distention of the tube, showing that a lumen contains a double ovum, the cavities of which do not connect (No. 825). Natural size.





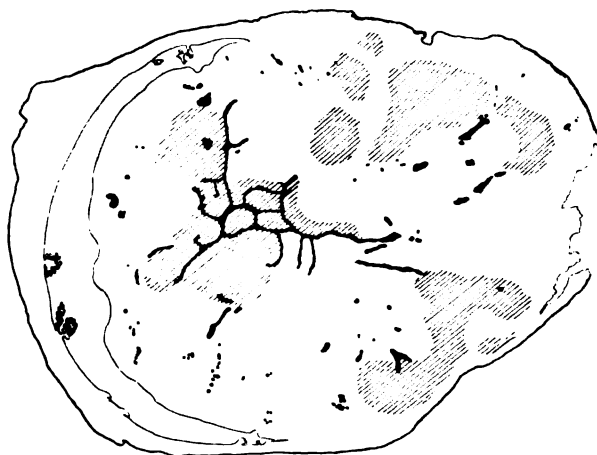


Fig. 1 (775)



Fig. 3 (729)



Fig. 2 (742)

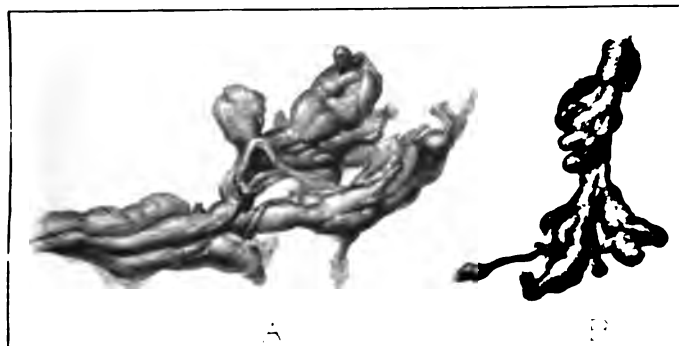


Fig. 4 (729)

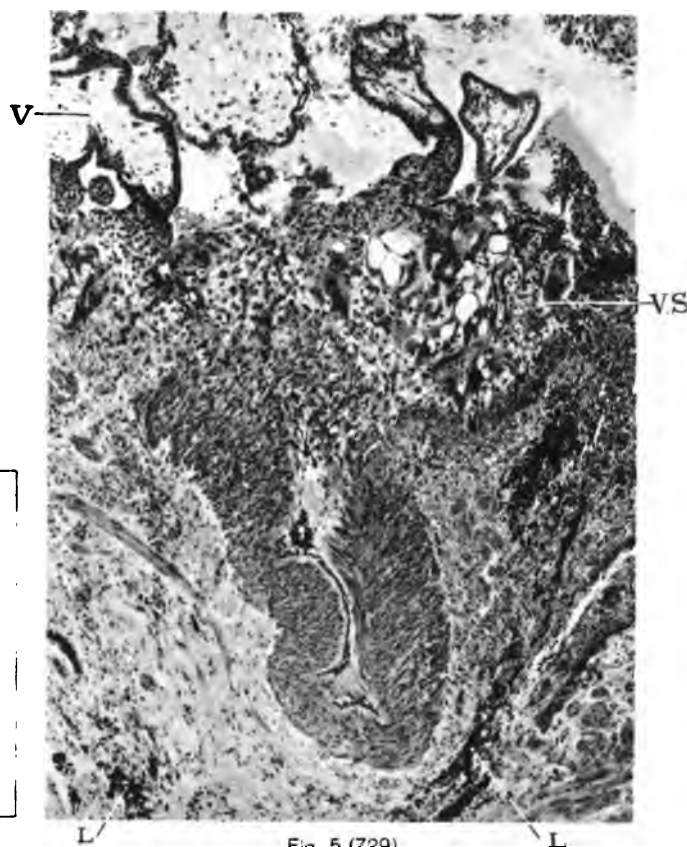


Fig. 5 (729)

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**FIG. 1.** Transverse section of the collapsed ovum within the tube (No. 775). The ovum and the villi form reticular bands which are drawn in black. The red blood clot is striated and the organized clot is white.  $\times 4$ .

**FIG. 2.** Very large hydrosalpinx (No. 742).  $\times \frac{3}{4}$ .

**FIG. 3.** Part of the ruptured tube from No. 729, showing the ovum which has escaped.  $\times 1$ .

**FIG. 4.** Several degenerated villi from No. 729.  $\times 12$ .

**FIG. 5.** Photograph of junction between tips of the villi and the tube wall (No. 729). An extensive mass of vacuolated syncytium is eating its way into a blood vessel with a thick wall. *V*, villus; *V. S.*, vacuolated syncytium; *L*, nest of leucocytes.  $\times$  about 50.





Fig. 1 (874)

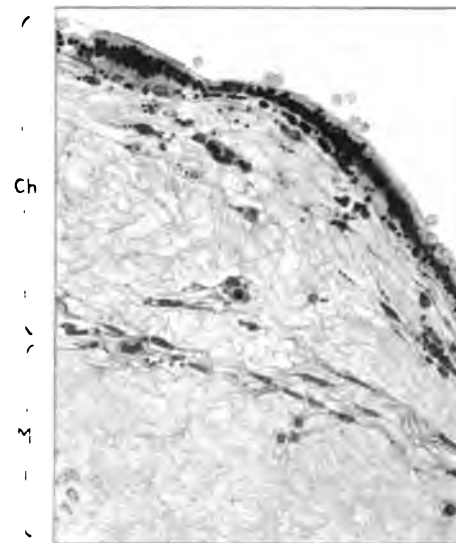


Fig. 3 (808)

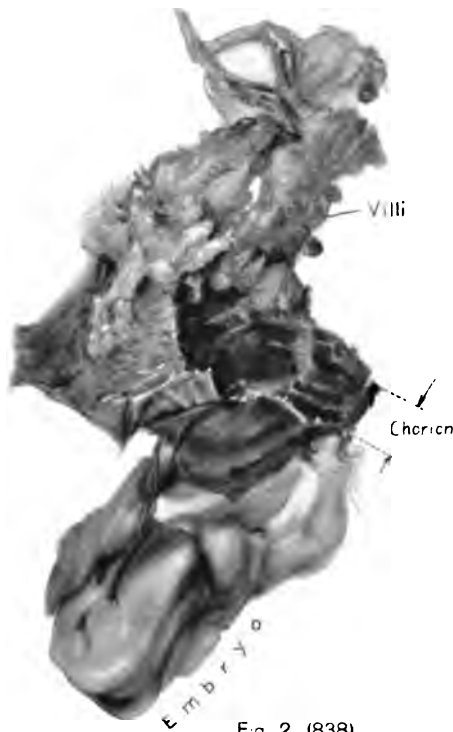


Fig. 2 (838)

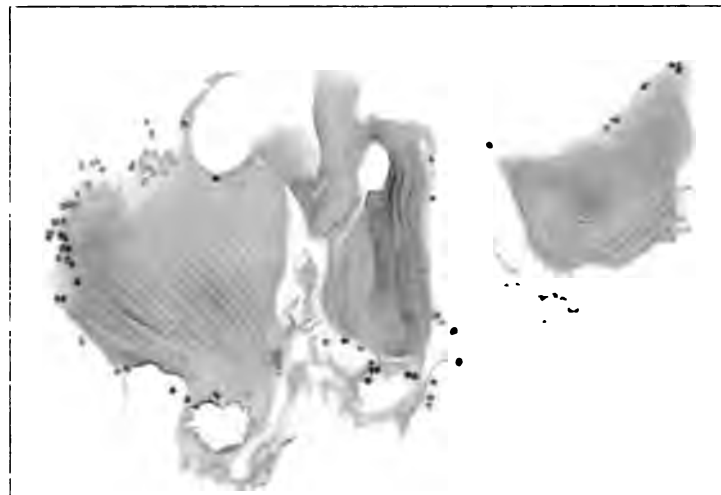


Fig. 4 (808)

J. F. DIDUSCH DEL.

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- FIG. 1.** Kinked tube with rupture at one point also showing tubal abortion (No. 874). Natural size.
- FIG. 2.** Distorted embryo after it has been carefully dissected out (No. 838).  $\times 12$ .
- FIG. 3.** Section through the chorionic wall and the adjacent magma showing the mesenchyme of the chorion *Ch* and magma *M* are continuous and belong together (No. 808). Stained with acid fuchsin.  $\times 300$ .
- FIG. 4.** Clumps of granular magma showing peculiar stratification which is especially marked by hæmatoxylin stain (No. 808).  $\times 175$ .

















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